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Original Articles

MALOCCLUSION IN THE DECIDUOUS DENTITION: SERIAL STUDY FROM BIRTH TO FIVE YEARS*

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MALOCCLUSION must be the result of heredity and/or environment. Heredity may be defined broadly as the factors which are sealed within the fertilized ovum. The environment is comprised of factors playing upon the fertilized ovum and its sequel within the uterus and postnatal factors. The effect of these environmental factors operating within this delimited time are to be examined with the evidence of this serial study of forty children. Heredity must necessarily have another approach and will only be considered by inference.

Individual impressions of the maxillary and mandibular arches were taken periodically with corresponding bites. Periodical medical, surgical, and dental histories were also recorded.

This group presents a heterogeneous sample of white children. Some of the parents are American born while others are foreign born of European origin.

All babies were full term and the mothers had uneventful pregnancies, except for one case of eclampsia. Thus, with this exception, the prenatal history contributed nothing that would interfere with normal growth and development.

At birth all the children were healthy, their weight ranging from 2.61 to 4.1 kilograms. However, three babies were born with oral defects; two of these having unilateral harelip with cleft palate of the hard and soft tissues; the other one having a cleft of the hard and soft palates. Another baby was born with defective external ear, the lobes being fused together.

The eruption of the teeth was in the accepted range, except for three children. Two children in the same family were late, whereas the other child had the maxillary first molars erupted before the lateral incisors.

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Read before the New York Society of Orthodontists, Nov. 11, 1941.

The general health was evaluated by the pediatrician. Nine were reported as excellent, 29 as good, and 2 as fair. In 19 children the diet was excellent, 13 good, and 8 fair.

In order to clarify the tables which are to follow, a few definitions are necessary:[1]

The anterior space between the segments of the gum pads is classified as follows:

Class A—The maxillary and mandibular anterior segments lie in their respective planes.

Class B—In the maxillary, the incisor segments are higher than the canine segments, while in the mandibular, the anterior segments are in the same plane.

Class C—In the maxillary, the incisor segments are higher than the canine segments, while in the mandibular the canine segments are higher.

Class D—In the maxillary, the anterior segments are in the same plane, while in the mandibular, the canine segments are higher.

The horizontal distance between the maxillary and mandibular lateral sulci (Character A) represents the posterior relationship of the gum pads at birth. In the dentition, Character A is the horizontal distance between the distal aspects of the maxillary and mandibular canines.

When the mandibular incisors lie lingual to the gingiva of the maxillary incisors, this will be considered as a case of horizontal overbite. Then again, when the maxillary incisors overlap to the gingival tissue of the mandibular incisors, this will be classed as a case of vertical overbite.[2]

A tooth is considered irregular when it is rotated from the accepted axis.

Occlusion is good when the triangular ridge of the mesiobuccal cusp of the maxillary first or second molar falls within the limits of the mesial or distal half of the cusps on each side of the buccal groove of the mandibular first or second molar. The maxillary molar should be in buccal occlusion.

TABLE I

COMPARISON OF ANTERIOR SPACE AND RELATIONSHIP OF GUM PADS AT BIRTH* WITH DECIDUOUS DENTITION

	CLASSIFICATION OF ANTERIOR SPACE				RELATIONSHIP OF GUM PADS (CHARACTER A) IN MM.	
	A	B	C	D	0 TO 3	4 TO 8
	19	14	4	3	28	12
Normal Horizontal	14 (83.6)	12 (85.7)	3 (75.)	2 (66.7)	23 (82.2)	8 (66.7)
Abnormal Horizontal	5 (26.4)	2 (14.3)	1 (25.)	1 (33.3)	5 (17.8)	4 (33.3)
Normal Vertical	16 (84.3)	10 (71.4)	3 (75.)	3 (100.)	20 (71.4)	12 (100.)
Abnormal Vertical	3 (15.7)	4 (28.6)	1 (25.)	--	8 (28.6)	--
Regular Teeth	8 (42.)	7 (50.)	3 (75.)	2 (66.7)	15 (53.6)	5 (41.6)
Irregular Teeth	11 (58.)	7 (50.)	1 (25.)	1 (33.3)	13 (46.4)	7 (58.4)
Good Occlusion	16 (84.3)	12 (85.7)	4 (100.)	2 (50.7)	25 (89.3)	9 (75.)
Malocclusion	3 (15.7)	2 (14.3)	--	1 (33.7)	3 (10.7)	3 (25.)

*Percentages are noted in parentheses.

In Table I the classification of the anterior space and the relationship of the gum pads at birth (horizontal columns) are compared with the deciduous dentition unfolding a normal bite or overbite, regular or irregular teeth, and good occlusion or malocclusion (vertical columns).

It can be seen that the majority of the babies fall in the classifications A and B. No one class seems to have a claim for any anomaly as shown by the distribution of the figures. When Classes B, C and D (cases having an anterior space) are grouped together and the total compared with the figures in Class A (cases having no anterior space), the comparison shows that the anterior space is not related to occlusion (Fig. 1). I have suggested previously that this anterior space is indicative of the order of eruption of the teeth.

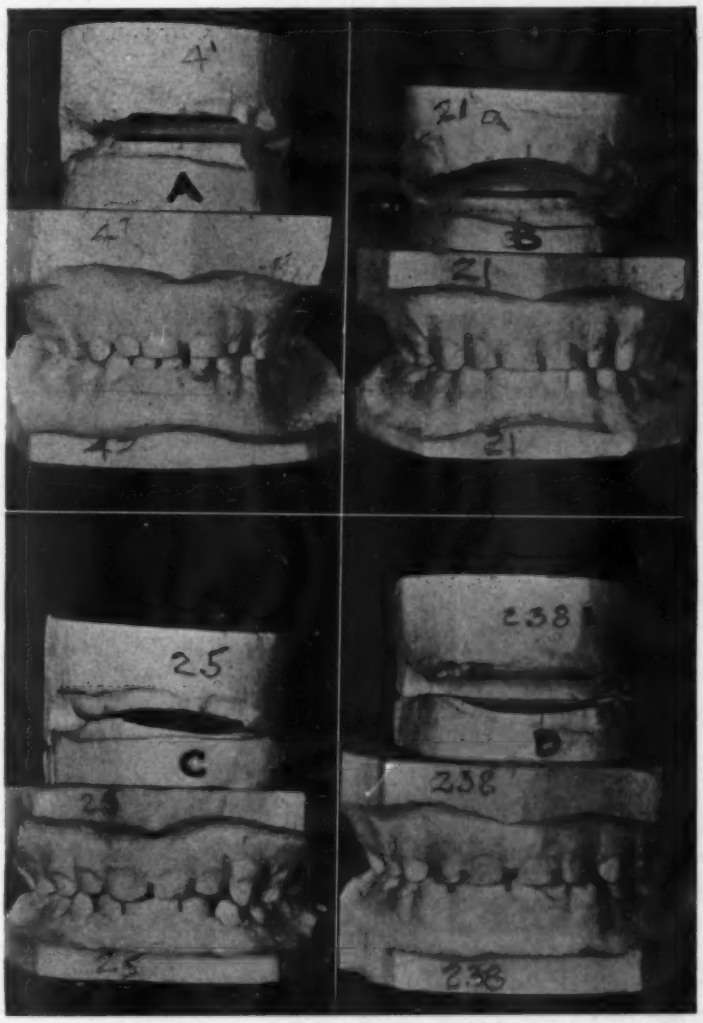

Fig. 1.—The classification of the anterior space at birth has no bearing on the relationship of the bite in the dentition. It will be noted that the corresponding dentition of Class A (Fig. 1*A*), Class B (Fig. 1*B*), Class C (Fig. 1*C*) and Class D (Fig. 1*D*) all develop into normal bites.

All the babies in this study had a posterior relationship of the gum pads at birth. Twenty-eight babies with Character A ranged from 0 to 3 mm. whereas twelve babies ranged from 4 to 8 mm. (Fig. 2). The values for abnormal horizontal and vertical overbites in the 0 to 3 mm. group are 5 and 8, respectively; whereas in 4 to 8 mm. the values are 4 and 0. This reversal of trend may be significant and is worthy of further investigation.

It is of interest that with the range of 0 to 8 mm. for Character A, the mandible must grow forward, move forward, or both, to the extent of 2 to 10

mm. more than the maxilla in order to establish good occlusion in the dentition. It is my present opinion that we can foretell which cases will develop into a posterior relationship of the permanent dentition during this developmental period.

The following postnatal factors will be considered; type of delivery, type of feeding, disease, mouth breathing and habits.

All of these babies were delivered by obstetricians, and only one sustained superficial trauma as the result of a high forceps delivery. There were 21 spontaneous deliveries with vertex presentation, 14 low forceps, 2 high and midforceps B, 1 breech, and 2 cesarean sections.

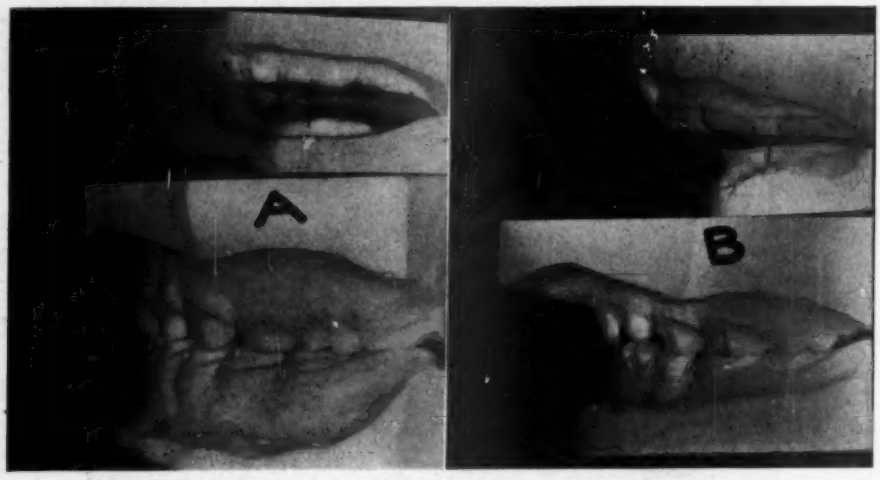

Fig. 2.—Two examples of extreme posterior relationship of the gum pads at birth. The mandible is 5 mm. (Fig. 2*A*) and 8 mm. (Fig. 2*B*) posterior to the maxilla. Nevertheless, their corresponding dentition presented good occlusion in both instances.

Trauma may occur during delivery either from instrumentation or from pressure on the head as the baby passes through the birth canal. The one case of instrumental trauma was too superficial to be considered an etiologic factor in malocclusion. Pressure on the head during labor causes molding, which is a temporary distortion and is mainly limited to the posterior half of the head. Hence it is extremely doubtful if the jaws are affected at all by this process.

TABLE II

ANALYSIS OF TYPE OF DELIVERY AND FEEDING*

	TYPE OF DELIVERY					FEEDING	
	SPONTANEOUS 21	LOW FORCEPS 14	HIGH & MID B FORCEPS 2	BREECH 1	CESAREAN 2	BREAST 16	BOTTLE 24
Normal Horizontal	16 (76.2)	11 (78.6)	2 (100.)	1 (100.)	1 (50.)	13 (81.3)	18 (75.)
Abnormal Horizontal	5 (23.8)	3 (21.4)	--	--	1 (50.)	3 (18.7)	6 (25.)
Normal Vertical	18 (85.7)	11 (78.6)	1 (50.)	1 (100.)	1 (50.)	12 (75.)	20 (83.4)
Abnormal Vertical	3 (14.3)	3 (21.4)	1 (50.)	--	1 (50.)	4 (25.)	4 (12.6)
Regular Teeth	11 (52.4)	8 (57.2)	--	--	1 (50.)	9 (56.3)	11 (45.7)
Irregular Teeth	10 (47.6)	6 (42.8)	2 (100.)	1 (100.)	1 (50.)	7 (43.7)	13 (54.3)
Good Occlusion	20 (95.2)	12 (85.6)	1 (50.)	1 (100.)	--	15 (93.7)	19 (79.2)
Malocclusion	1 (4.8)	2 (14.4)	1 (50.)	--	2 (100.)	1 (6.3)	5 (20.8)

*Percentages are noted in parentheses.

The distribution for type of delivery, in Table II, is fairly uniform. Furthermore, most of the irregularities of the teeth follow a general pattern. The four incisors are mainly affected in a symmetrical manner, similar to that which would be found in the arrangement at birth, if examined by roentgenograms. This suggests that the rotations are caused by lack of growth, or some other factor associated with development, and not by trauma.

Two of the babies were delivered by cesarean section. One was elective. The other was sectioned after a trial labor. However, the head was not engaged and consequently was not subjected to trauma. Both of these babies have malocclusions (Fig. 3).

One baby who is not included in this report, as she is only 1½ years old, was injured by the forceps causing a partial unilateral paralysis of the facial nerve. This had completely disappeared by the time she was 9 months old, and her casts showed good development and symmetry, even at birth. Furthermore, in my previous report, the dimensions of the jaws were studied in relation to types of deliveries. All the findings support the statement that the type of delivery is not an etiologic factor in malocclusion.

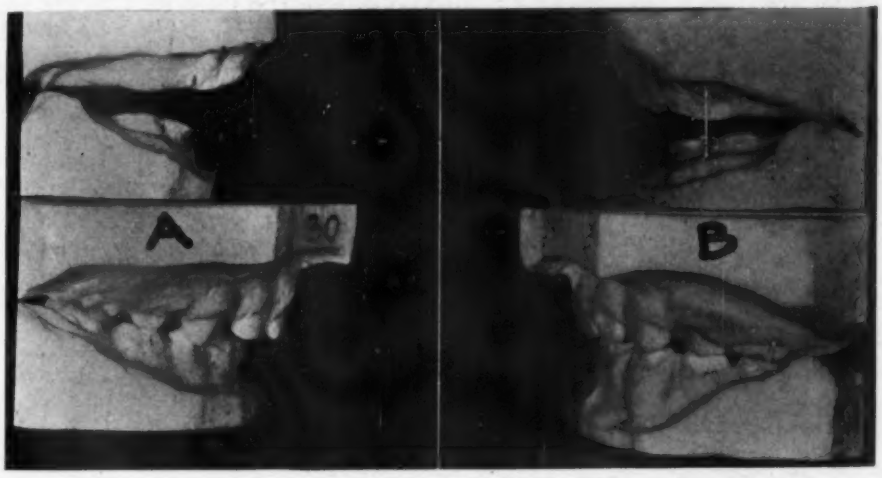

Fig. 3.—Illustrations of two babies delivered by cesarean section; (*A*) elective, (*B*) sectioned after trial labor. Both cases have a bilateral posterior occlusion.

Sixteen babies were breast fed for two months or more and are classified under breast-fed, whereas the remaining twenty-four babies are classified under bottle-fed. In the breast-fed babies only one had malocclusion while there were five babies with malocclusion in the bottle-fed class. Although this finding creates suspicion, a study of all the factors leads me to believe that the method of bottle-feeding is not the cause of malocclusion (Figs. 4 and 5).

Little is known as to the effect of disease on the growth and development of the jaws. Todd says: "But as the face, like the rest of the body, is a plastic thing and since the adult contours are the end-result of a growth pattern which, in the course of progress, may be expedited, interrupted, retarded, warped, or inhibited by misadventures of health and by vagaries in the interplay of those organically originated influences by which the pattern is promoted, it is evident that environment, external and more particularly internal, must contribute in no small manner to the final result."[3]

Under the classification of disease, children who had only an occasional cold or mild illness of a couple of days' duration, or no illness, are included in the no-illness group. The other children, listed in the illness group, had measles, chickenpox, mumps, whooping cough, pyelitis, food allergies, pneumonia, streptococcus infection of the throat, frequent colds, etc. Also in this group were children with surgical histories, i.e., removal of tonsils and adenoids, strangulated hernia, closure of harelip, etc.

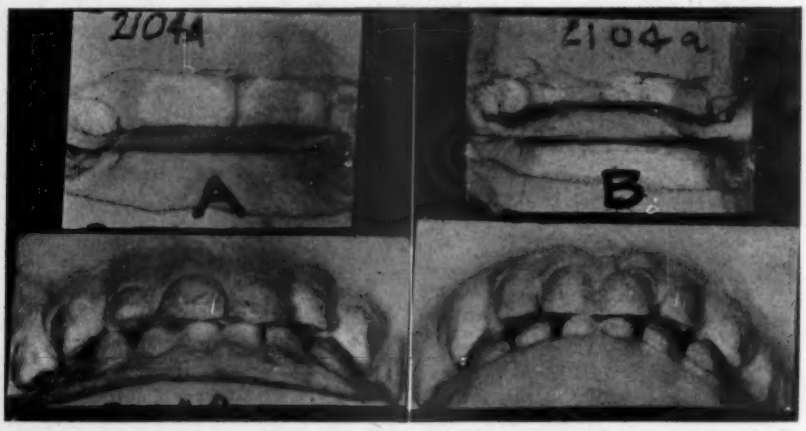

Fig. 4.—Examples of a brother and sister who were breast fed for one year. Both have similar histories, i.e.: Spontaneous, breast fed for 1 yr., no illnesses, general health good, diet fair, no mouth breathing, no habits, excellent occlusion.

The maxillary lateral incisors are rotated distally and are slightly protruding. There is nothing in the histories to account for this deviation and, therefore, I believe the cause to be heredity.

Fig. 5.—Casts of two children with a number of common factors as seen by their histories:

A,	*B,*
Male	Male
Breast fed 6 mo.	Breast fed 3 mo.
Chronic infection of the tonsils and adenoids	Mumps at 2 yr. 9 mo.
Swollen cervical glands accompanied by temperature	
Frequent tonsillitis from 17 mo. to present time	
General health good	General health good
Diet good	Diet good
No sucking habit	No sucking habit
No mouth breathing	No mouth breathing

Both have good molar relationships and incisal openings, the mandibular canines having a labial tendency. The premaxilla seems to be the area involved. These anomalies must be due to constitutional factors and/or heredity, and I am inclined to believe the latter to be the cause.

Abnormal overbite in the illness group has a ratio of 8 to 1, which may be significant.

Mouth breathing is the result of obstruction due to hypertrophic lymphoid tissue, deviated septum and edema of the nasal mucous membrane. Cooke[4] says, "Up to the age of 6 obstruction is frequently due to adenoid and tonsillar

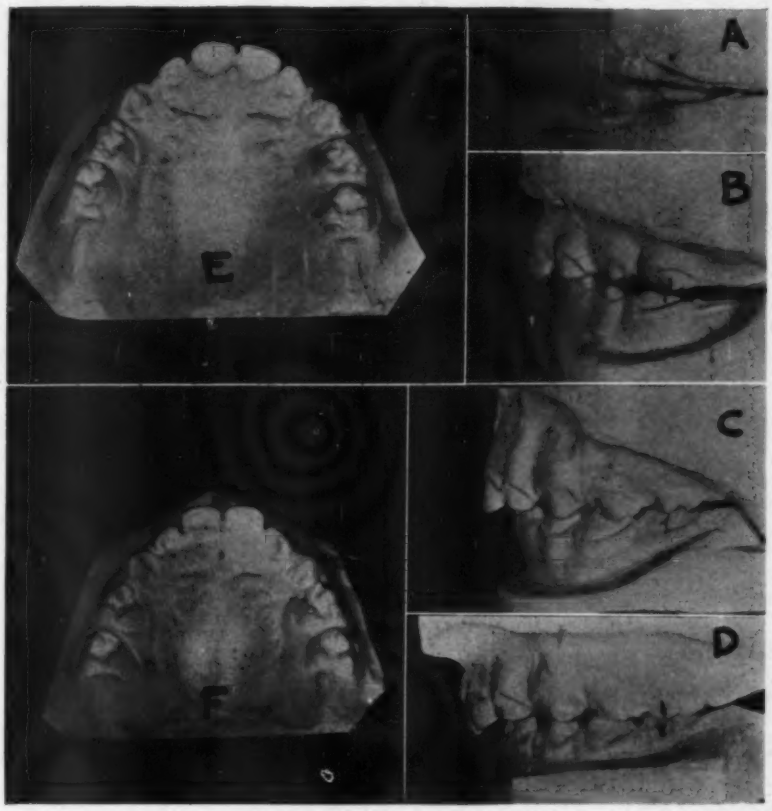

Fig. 6.—Casts of a mouth breather from his first year with the following history: Male, low forceps, bottle fed, continuous colds, tonsils and adenoids removed at 2 yr. 2 mo., general health excellent, diet excellent, mouth breathing from 1 yr. to present time.

Note variation of the vertical overbite between Fig. 6*C* and 6*D*. The horizontal overbite is evident in 6*B* and is maintained throughout the series. Marked spacing is present between all the teeth as soon as they are erupted. Fig. 6*E* is maxillary view of casts 6*D*. Note the excellent development. The overbite seems to be due to lack of harmonious development between the maxilla and the mandible. Also note the slight rotation of the maxillary left lateral incisor in Fig. 6*E* and the similar rotation in Fig. 6*F*, his younger brother who was not a mouth breather.

hypertrophy usually associated but occasionally existing separately. Whether adenoid hypertrophy is due to heredity, nutritional defects or infection, is not known; but certain it is that infection, if not primary, soon is established, with resulting infection of the nasal and sinus membranes. The absence of proper nasal function leads to arrested facial development which causes septal deflection, a narrow high-arched palate and an overdevelopment of the anterior portion of the maxillae."

The mouth breathers, regardless of cause, are grouped in Table III. There were 8 mouth breathers and 32 normal breathers. Of the former group, 7 had enlarged tonsils and adenoids; 5 of these children having them removed. The findings do not suggest any relationship between mouth breathing and occlusion (Figs. 6 and 7).

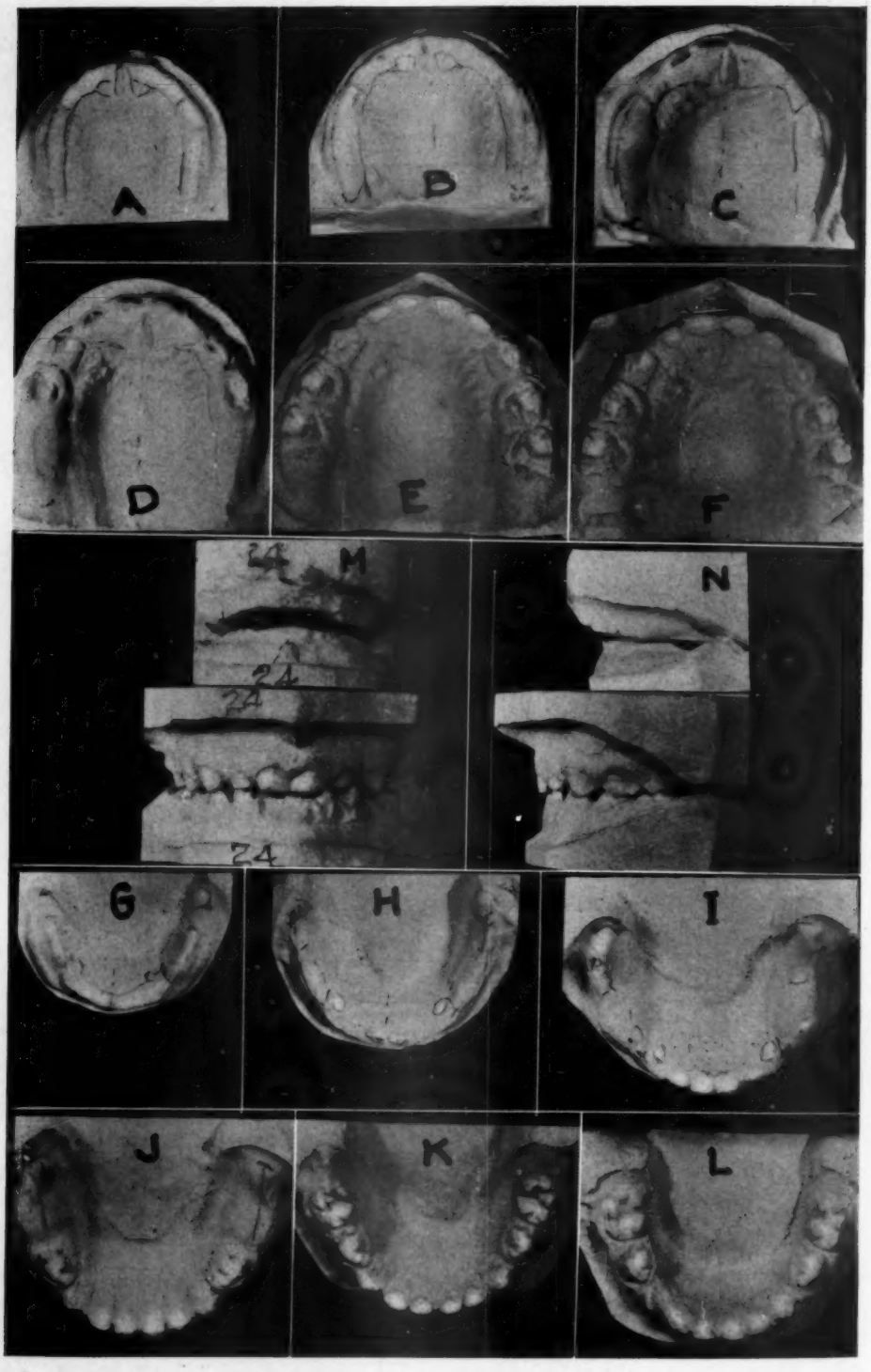

Fig. 7.—Another mouth breather with the following history: Male, low forceps, bottle-fed, continuous colds, tonsils and adenoids removed at 3 yr. 3 mo., general health good, diet excellent, mouth breather, no habits.

Note excellent alignment of the teeth throughout the series and good occlusion.

Under the heading of habits are grouped the finger-, tongue-, lip-suckers or biters. Practically all of these children, if and when the habit was broken, followed with nail-biting or masturbation.

Most of the arguments in the past on the effect of sucking have not been based on evidence but rather on an emotional and illogical approach. Permit me to repeat what I have said in a previous paper.[2] "A force of certain intensity and duration will change the position of the teeth and the surrounding

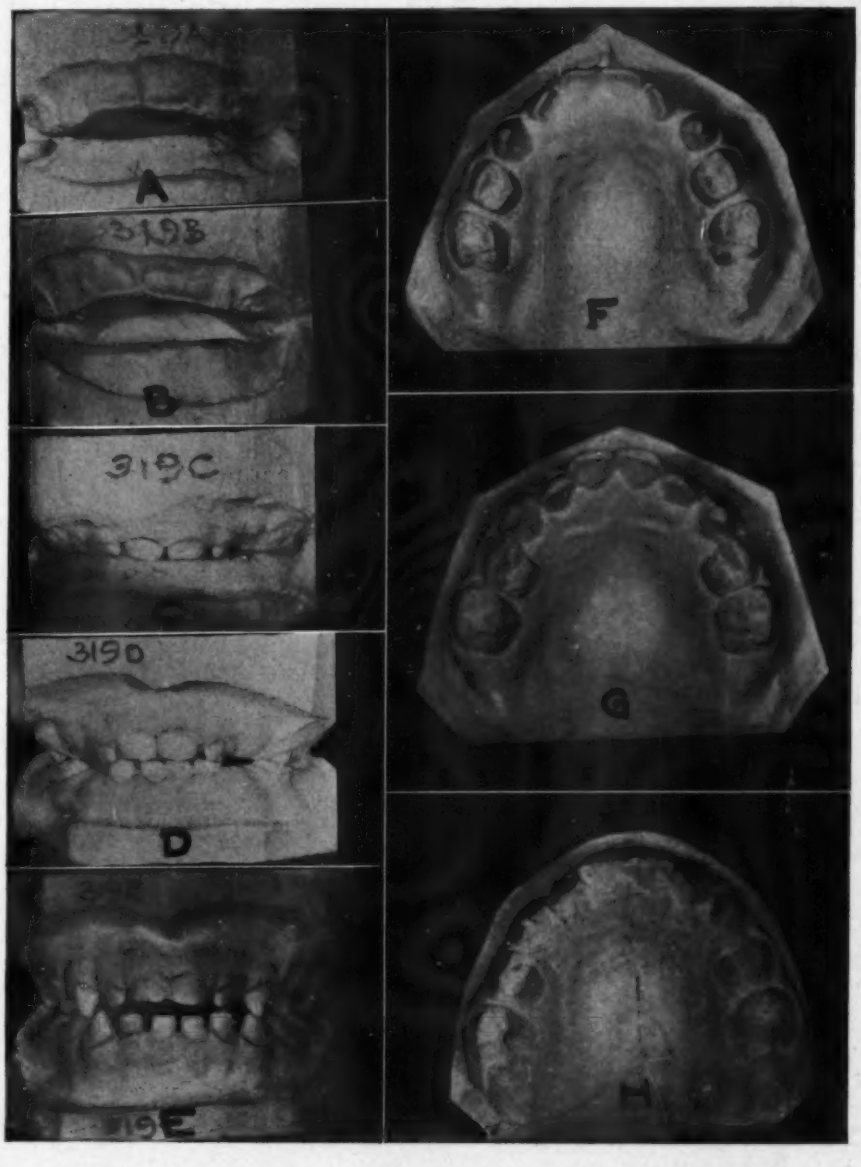

Fig. 8.—A thumb-sucker with negative parental interference. Male, low forceps, bottle-fed, no illnesses, general health good, diet fair, no mouth breathing, sucked thumb from infancy, with parent constantly pulling thumb out of mouth and slapping hand.

Note the Class B relationship of the gum pads in Fig. 8*A* and the asymmetric development shown in 8*B*. Note closure of the bite with eruption of the incisors in 8*C* and again in 8*D* with the first molars erupted. In 8*E* the bite is opened, which seems to be due to lack of growth in the intercanine region as well as the thumb-sucking which was greatly activated by parental interference. Fig. 8*F* is maxillary occlusal view showing marked rotation of the lateral incisors and yet there is no crowding. Fig. 8*G* and *H* are maxillary occlusal views of his older brother and sister. Neither were suckers, yet they also have rotations of the lateral incisors.

TABLE III

ANALYSIS OF DISEASES, MOUTH BREATHING AND HABITS*

	DISEASES		MOUTH BREATHING		HABITS	
	NO ILLNESS	ILLNESS	YES	NO	YES	NO
	9	31	8	32	17	23
Normal Horizontal	8 (88.8)	23 (74.2)	6 (75.)	25 (78.3)	11 (64.7)	20 (86.9)
Abnormal Horizontal	1 (11.2)	8 (25.8)	2 (25.)	7 (21.7)	6 (35.3)	3 (13.1)
Normal Vertical	6 (66.7)	26 (83.8)	7 (87.5)	25 (78.3)	13 (76.5)	19 (82.6)
Abnormal Vertical	3 (33.3)	5 (16.2)	1 (12.5)	7 (21.7)	4 (23.5)	4 (17.4)
Regular Teeth	5 (55.5)	15 (48.3)	3 (37.5)	17 (53.3)	10 (58.8)	10 (43.5)
Irregular Teeth	4 (44.5)	16 (51.7)	5 (62.5)	15 (46.7)	7 (41.2)	13 (56.5)
Good Occlusion	7 (77.5)	27 (87.2)	7 (87.5)	28 (84.4)	14 (82.4)	20 (86.9)
Malocclusion	2 (22.5)	4 (12.8)	1 (12.5)	5 (15.6)	3 (17.6)	3 (13.1)

*Percentages are noted in parentheses.

structures. It makes no difference whether the force is applied with an orthodontic appliance or a thumb, but we do have to be sure that such a force is operating.''

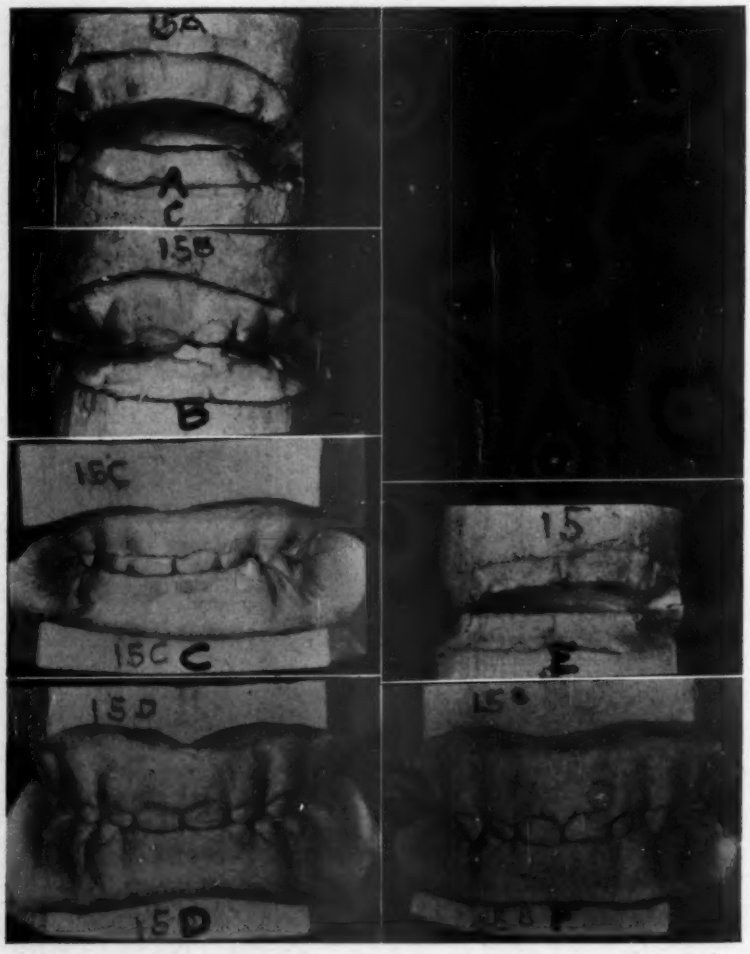

Fig. 9.—Spontaneous correction of displaced teeth after sucking and biting stopped. Note displacement of maxillary left central and lateral incisors (9*B*). The habit was broken by splints placed on the arms. Fig. 9*C* and *D* show the displacement corrected. Note vertical overbite in Fig. 9*D*. (9*E* and *F* are two casts of the sister, who also was a sucker). Note similarity in the vertical overbite of both children, which suggests heredity.

The only area which may be affected by this habit is the site of application, i.e., the anterior region (Fig. 8). The molars are not involved. For example,

Fig. 10.—Another example illustrating spontaneous correction upon cessation of the habit. The child sucked his thumb without parental interference from 7 mo. to 4 yr. 2 mo. During the interim between the taking of impressions for casts 10*B* and 10*C* he acquired a baby sister, which seemed to increase the activity of the sucking habit. When casts 10*C* were made, the child was told for the first time that sucking "made his teeth crooked." Being 4 yr. 2 mo. at the time, he was capable of understanding the situation and has never sucked his thumb since. The succeeding casts show the progressive correction.

2 babies were such ardent suckers and biters of their thumbs and fingers, as to cause lacerations. In neither case was the molar relationship disturbed. The force which maintains the mandible in its proper position is far greater than the force of the sucking. However, an orthopedic collar may prevent the normal forward translation of the mandible and cause a malocclusion, particularly before the first molars have erupted.

From Table III it is to be seen that irregularities and malocclusions are common to both suckers and nonsuckers. The horizontal overbite, as expected, is the area affected. The horizontal overbite was greatest when parents interfered. Parents who understand the cause of sucking will permit the child this needed outlet. If the child does not stop this habit voluntarily by the age of 4 years, then with intelligent handling he can be helped to break it (Figs. 9, 10, and 11).

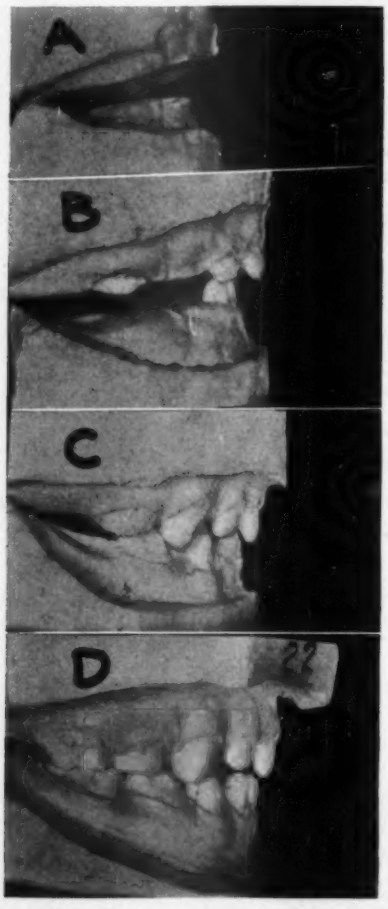

Fig. 11.—Serial casts of a thumb-sucker from 6 mo. showing no effect on dentition: Male, breast fed 4 mo., whooping cough at 1 yr. 5 mo., measles at 3 yr. 11 mo., streptococci infection of throat at 4 yr., general health good, diet good.

Note the good alignment of teeth and good occlusion throughout the series.

SUMMARY

1. The anterior space between the gum pads at birth has no bearing upon the deciduous dentition.

2. Babies at birth have a posterior relationship of the jaws ranging from 0 to 8 mm. The mandible must grow forward, move forward, or both, to the

extent of 2 to 13 mm. more than the maxilla. It is my present opinion that we can foretell malocclusion in the permanent dentition during this developmental period.

3. Up to the age of 5 years, the type of delivery, method of feeding, and mouth breathing do not appear to be factors in malocclusion. The factor of disease needs further investigation.

4. Irregularities of the teeth due to sucking were spontaneously corrected soon after the habit was stopped. In the event that sucking continues after the fourth year, the child should be helped to stop this habit.

5. Heredity seems to be the most important factor in irregularities and malocclusion in the deciduous dentition.

I wish to thank Dr. Charles Hendee Smith, Dr. William E. Studdiford, and Dr. Leo Winter in whose departments at Bellevue Hospital part of this study was carried out; and Dr. Harry Bakwin who was always ready to help, and finally the parents and children who cooperated in this study.

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667 MADISON AVENUE

THE POSTURE OF THE MANDIBLE

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STIMULATION acquired from regular attendance at the Greater New York Meetings for Better Dentistry is responsible for this paper from a general practitioner's viewpoint, on the subject of posture in relation to occlusion.

First I want to pay tribute to Dr. Riesner, your president, for the valuable services he has given in making those meetings so successful. Second, I would like to mention a few personal impressions gained from these programs, especially as they relate to orthodontics.

1. That very few meetings occur now where the general dentist addresses specialty groups.

2. That each specialty has its own definition of occlusion which may be at variance with that of some other specialty.

3. That the lack of coordination between the branches of dentistry tends to retard its progress as a whole.

4. That the specialist's conception of nature's plan of occlusion is not sufficiently comprehensive. He works within a restricted age group mainly; therefore, he lacks opportunities to observe and analyze all the progressive changes that occur in dentures between youth and old age.

Orthodontic treatment is concerned with a very vital region in relation to systemic health because of the many different functions involved within the oral cavity. It is unfortunate in one way that children receive most of the benefits from this specialty of dentistry. Because young patients adjust and compensate so readily to abnormalities, the health benefits accruing from corrective therapy are not as widely recognized as they should be. Furthermore, if orthodontists treated older patients, whose compensatory rate is much slower and the systemic reaction to malocclusion more acute, they would be in a better position to appreciate the value of the health services they themselves render.

Dental treatment began independently of medicine on a relief, repair, and replacement status. To date, consideration of physiologic reactions has not received adequate support. In the last few years, however, there has been a closer cooperation with medicine, mainly through cointerest in pathologic subjects.

We feel that the way to coalesce with medicine is through a better understanding of the body mechanisms involved in somatology. The definition of somatology is the study of anatomy and physiology. We are dealing with anatomy and physiology coordinated with the study of dynamics. Growth and development, form and function are examples of this activity in our field; supply and demand in the economic field; and give and take in the fighting field. In other words, anatomy and physiology should be construed as one subject when associated with the science of energetics.

Read before the New York Society of Orthodontists, Nov. 10, 1941.

Dr. Hooton, the Harvard anthropologist, once told the medical profession to leave the morgue and go to the cradle to get a better understanding of life's processes. Our approach is the study of forces in motion within living tissues. A better understanding with medicine would develop if both professions utilized more effectively recent knowledge available concerning the central nervous system, endocrinology, organic chemistry, psychology, and vital dynamics. Very superficial study of these subjects makes me realize that older practitioners in both professions must continually hustle to keep abreast of present-day standards.

A few thoughts which stand out prominently from a cursory survey of these subjects may be emphasized here.

1. Life is motion.

2. All energy is created through intake of food, water, and air; is regulated by the brain and the special senses of sight, sound, touch, smell and taste; and is finally converted into either motion or secretion.

3. Normal activities aid in the maintenance of health, and abnormal activities tend toward disease.

4. Nature is always seeking an equilibrium of forces, but never accomplishes it until death occurs.

5. The nervous system must be better understood, especially the proprioceptive system, before postural correction is attempted.

6. Psychic influence must be considered in body functions. Emotion, especially as it relates to chemical changes, and the application of the willful act in conditioning and reconditioning reflexes are forces to be considered.

What is the normal posture of the mandible? It is that position which requires the least amount of energy on nature's part to maintain the mandible in its normal structural relationship to the cranium. The structural relationship means that its three planes must harmonize with the three planes of the head. The semicircular canals which establish these planes for all body movements are located within a half-inch of the condylar heads.

All movement begins and ends with posture. In the normal posture of the mandible there is no contact between the teeth. The mandible does not articulate with the maxilla; it functions against it. It articulates with the cranium. This relationship makes a study of its movements a complex problem. It is the second bone in the body to calcify, the clavicle being the first. The mandible is motivated for many different functions—as an aid to mastication, deglutition, mucus drainage both from the naso- and oropharynx, middle-ear ventilation, emotional expression, body orientation, and as a stimulant for facial development.

At birth its position is under the skull, but in its development downward and forward it enlarges the base of the oral pharyngeal funnel, the apex of which is the thyroid cartilage with the hyoid bone between. As it grows forward, it influences facial development by the forces it exerts through the teeth to the maxillary bones. It also helps to position the hyoid bone in its relation to the larynx. Through its cranial muscle attachments the mandible aids in maintaining the posture of the head by way of the hyoid muscle mechanism to the anterior chest wall, thus counteracting the pull of the postvertebral muscles. The bone acts as a support for the anterior part of the shoulder girdle. Normal

tonus in the neck aids in balancing the spinal load upon its vertical axis. The curve of Spee and the compensating curve are formed as the result of the forces activated by the motivation of the mandible. These occlusal curves on the tooth surfaces tend to converge the resultant of masticating forces to a fixed point within the skull. This point is the structural center of the denture and should be the center of rotation for all functional movement. However, as a result of any force creating malposture by inhibiting the free motion of the mandible, a loss of symmetry occurs and the functional center moves away from this structural center.

As a result we have an engineering problem in vital dynamics to solve. Present-day construction in the material world is developed with the aid of a plumb line, a spirit level, a rule, compass, and a triangle. How could a mechanic possibly plan or build a forty-story office building or a thousand-foot ship without the aid of engineering equipment? Development of body posture through structure requires the same study of energetics that is needed to create these inert objects. The only difference is one of material and maintenance. Todd,[1] in her book *The Thinking Body,* brings this comparison to a logical conclusion.

We must not leave the study of mandibular activity without mentioning the force that volition can play in maintaining or correcting postural positions. Dr. Alfred P. Rogers,[2] as you know, has stressed this subject for years as myofunctional therapy. However, benefits accruing from neuromuscular therapy in conditioning and reconditioning reflexes are not very widely understood, mainly from the lack of opportunity to see the results that occur in well-controlled cases. Orthodontia needs badly institutional environment to study and develop this form of treatment. It has been my privilege to see the advantages of institutional control in speech correction through psychofunctional methods. The results obtained by organizing these forces and utilizing them through muscle expression are astounding. For example, in a cleft palate case the tissues from the throat were formed into a palate by surgical means and then made to function in short order by practicing cerebral motor innervation 5,000 times a day.

Another example of neuromuscular therapy developed by Martin[3] is to increase tension in relaxed vocal cords caused by a hyoid bone forced distally by a retro-positioned mandible.

Nature's plan is to grant the mandible freedom of action to perform its many functions and makes the temporomandibular joint secondary to the occlusion of the teeth. When action is inhibited as in cuspal interference, abnormal forces arise which must be adjusted. Especially if these occlusal forces are shearing or torsional forces and are not relieved, they necessitate changes either in the tooth surfaces, alveolar processes, or in the posture of the bone itself. If the posture is altered, the musculature of the head is affected. There are approximately ninety pairs of muscles in the head area leading to the chest wall, and who knows which ones are most affected from structural imbalances?

It is not for me to advise orthodontists which treatment is best to overcome these disturbing forces, but when grinding is resorted to for corrective purposes by periodontists under the term "to equilibrate" instead of "to balance," I feel that it is time to consider the meaning of these terms. It is possible by grinding to obtain mechanical balance in two planes, as in plane geometry, but in the

human mouth we are dealing with three dimensions, as in solid geometry, to establish physiologic equilibrium, and you disturb muscle tonus or mandibular posture, if this third dimension is altered in this grinding process.

The method usually employed in restorative work, where normal function is sought in three dimensions, is to register the movements of the mandible as a guide. However, in many cases, especially in immediate replacements after extractions, this registration records the pathologic activities of a mandible which is functionally imbalanced. Added to this, if the bite is opened on these measurements, the abnormality is accentuated. Better treatment would be to allow some time to elapse, even though cuspal interference has been eliminated, before attempting to restore mouths where there is pronounced malposture of the mandible if surveying equipment is not available. Nature would then compensate somewhat during this period from the effects of noci tactile registrations.

There is probably no other joint in the body where the tendon tensions may vary so much as in the temporomandibular joint. This is due to the great changes possible in vertical dimensions from serious disturbances of the bite level. Magnus[4] has demonstrated that the loss of a very few millimeters between tendon attachments will remove all tonus from the muscles involved.

In restorative work we must establish a structural unit that will work in harmony within physiologic limitations rather than with pathologic movements.

Nature loves symmetry, and while she seldom attains it, she is always sympathetic toward it.

Simon[5] says, "It is obvious that we are dealing with a mathematical problem. The denture of man is an object, positioned in the head cavity, and if its location is to be definitely determined, it must be measured in three dimensions. One wonders why the practical utilization of this mathematical foundation was so long postponed."

Stoll[6] advocates the use of a precision instrument of a geometric type to survey a structural occlusion which will function in a mandible properly oriented in postural relationship to the skull.

What does the general practitioner encounter in his practice? Patients come to the general practitioner with all types of occlusal conditions: Those with fine functioning dentures which demonstrate clearly nature's plan of harmonizing structure and function; many with very minor inhibitions, the correction of which will prevent serious trouble later on; patients minus six-year molars handicapped by a deficiency in vertical growth and drifting of the remaining teeth; patients with diseased gums due to abnormal stresses exerted on the tooth surfaces; patients with many cavities resulting from trophic disturbances caused by malocclusion; patients whose hyoid bone moves in deglutition like an operating pile driver and who complain of biting their tongue, or cheek, or of a lack of tongue space, or of difficulty in speech, or of changes in facial expression. Systemic disturbances are easily recognized in these cases, and we feel that parasympathecatonias result from these conditions similar in action to sympathecatonias from emotional irritation. Dr. Pottenger,[7] in his book on the visceral nerve system, lists the reflexes in facial areas from body dysfunctions. There is a grand opportunity to classify these reactions in reverse, that is, to compile the systemic reactions caused by noci facial stim-

ulation. Among the few reactions he mentions in the head area is that pressure on the eyeball or pressure on the mucous membrane of the nose, slows the heartbeat ten beats per minute in an average case. As these are both examples of fifth nerve nociceptive stimulation, why would not noci stimuli from malocclusion present the same reaction? Lüscher[8] demonstrated another example of irritation by the following experiment: He looked through an orifice in the tympanic membrane and saw the stapedius muscle inhibit the stapes. This was caused by fifth nerve irritation created intentionally at the external meatus. As this muscle is innovated by the seventh nerve, it shows clearly how these nerve currents interplay.

For those interested in the chemical study from a dental viewpoint, Dr. Broderick's book on "Dental Medicine" is the best source of information I have seen.

A few practical cases with their histories and brief testimonials are presented. These cases are divided into different ages: one 5½ years, another 28, two in the forties, one in the fifties, one 70, one 94.

A. *B.*

Fig. 1, Case 1.—*A*, View before beginning of orthodontic treatment. *B*, View four months later. Systemic improvements due to more vital reactions than merely improved masticating efficiency.

CASE 1.—A boy 5½ years old was referred by Dr. Seaver because of a tongue tie and a speech defect. He was badly undernourished, weighing only 31 pounds. Four different physicians had been unable to help him. In fact, one told his mother that he did not think that she would have him long. His mandibular teeth were in linguoclusion and only slight contact between two molars prevented complete closure onto the mucous membrane of the maxilla. This situation interfered with his jaw movement, prevented proper deglutition;

his close-bite crowded the tongue distally, causing dysfunction of the hyoid bone. Thus a drainage problem in the throat was created. Orthodontic treatment by Dr. C. P. Bonin was started and in four months' time the boy weighed 51 pounds, a gain of 70 per cent. His appearance, posture, and other systemic reactions were equally improved. Dr. Seaver reported sufficient progress in speech to make a tongue operation unnecessary.

CASE 2.—A woman 28 years of age had exceptional teeth in color and shape. She was referred to Dr. Stoll.

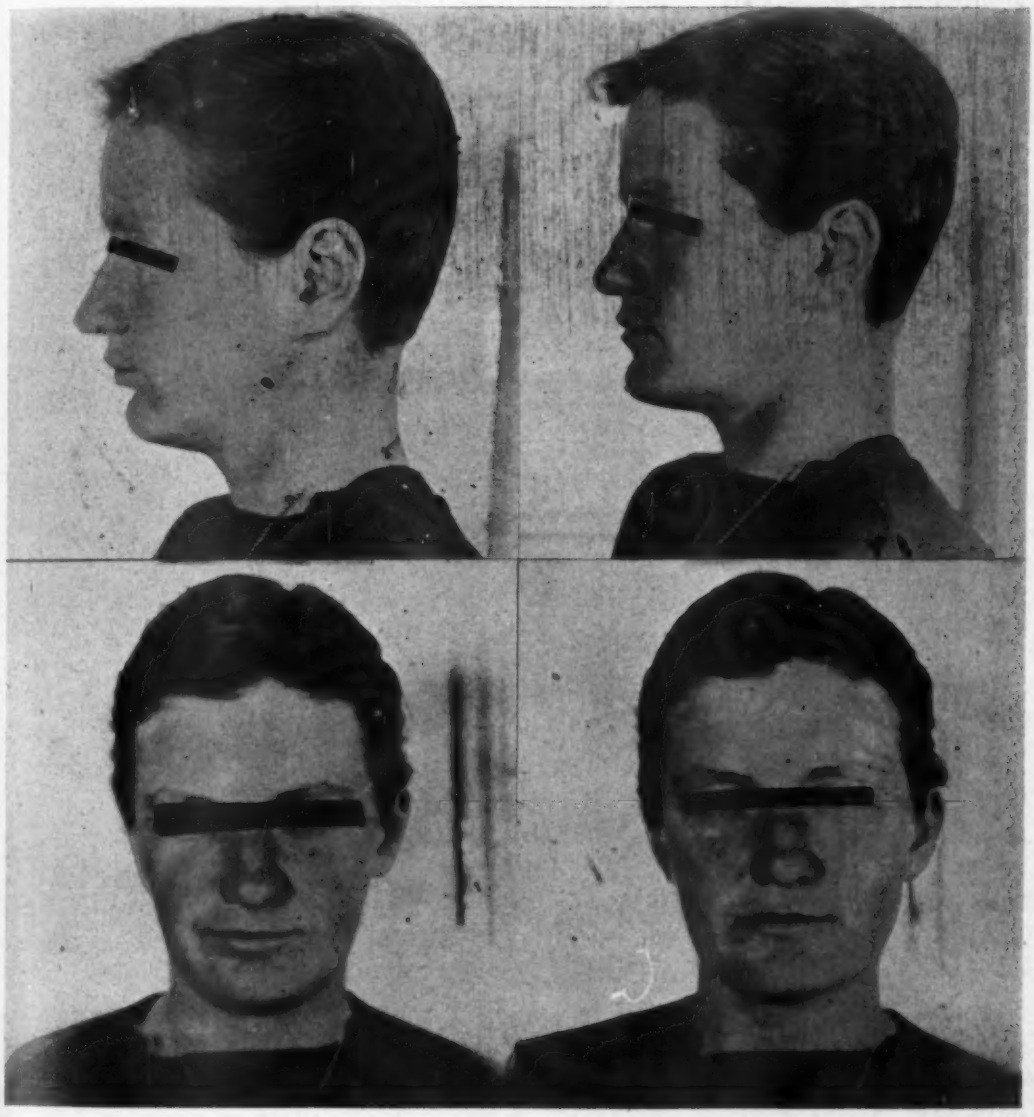

Fig. 2, Case 2.—*A*, Profile views before and after initial treatment. Pictures were taken the same day. Right view shows the mandible correctly postured by means of a scientifically designed bite plate. *B*, Front views of same patient. Note the release of torsonial stresses around the mouth in the right picture.

History.—Maxillary central incisors had been pushed lingually in an accident a few years back and had remained in this position. Her family dentist did not recognize the need of dental treatment. Shearing forces had guided

the mandible into retro-position and the bite was locked. A removable metal splint with a predetermined bite was placed over her teeth with finger springs attached for pushing forward the depressed teeth. Three weeks later she visited the physiotherapist who had treated her from childhood for lack of postural tonus in the entire body. This is the report of the changes that had already occurred. "Before treatment the mastoid processes were at different levels. The curve in the upper dorsal area not correctible. Breathing impeded. Lumbar curve unstable. Jaw very tense. All conditions were improved and the third cervical vertebra was repositioned which previously had been considered permanently locked in malocclusion." This patient in early childhood was treated by physicians unsuccessfully, but today by the neuromuscular exercises taught her she earns her living giving horse-back riding lessons.

CASE 3.—A neurologist 38 years of age, from another state, sensed the need for reposturing of his mandible, after reading Dr. Seaver's[10] and my[11] articles.

He had visited a leading hospital in a large city for a complete head examination. His eyes, ears, nose, and throat were thoroughly examined with negative results, and he was turned over to the dental specialist for oral examination. He had thirty good teeth in his mouth, very few fillings and was told that his malocclusion could do him no systemic harm. I referred him to Dr. Stoll. A few months after treatment started, I wrote to this neurologist to find out what reactions had occurred, and I quote directly excerpts from his letter in reply. "I am, of course, very glad to write you about the progress I have made from treatment. First of all I will state the complaints which I had prior to the start of treatment: (1) Left palpebral fissure narrow. (2) Spasmodic contractions of left orbicularis oculi which often could not be controlled at all. (3) Inability to close the jaws to a comfortable position; could not bite down firmly on all molars. (4) Frequent aching of lower incisor teeth. (5) Hyperirritability of left ear to sounds, particularly on using telephone. (6) Difficulty in swallowing, awkward and conspicuous feeling and excessive noise on swallowing. (7) Excessive salivation, particularly on speaking for moderately long periods. (8) Irritative sensation in larynx, dryness, soreness on speaking.

"The first step in the treatment was a certain amount of grinding of various teeth. Immediately I had more comfort in that I could bring my jaws together fairly well for the first time in several years. The second step was having a splint affixed encasing all the upper teeth. I then had further comfort in bringing my jaws together. From then on the twitching of the left eyelid and upper part of the face diminished fairly steadily. Also the left palpebral fissure gradually increased until it was the same as my right. This was noticed by my medical colleagues. Also, following the insertion of the splint, the mandible seemed to, and gradually did, move forward ventrally and I gradually noticed improvement in my swallowing and a diminution of salivation when speaking, and increasing endurance of the vocal cords. My general health and sense of well-being have improved since treatment has been under way. I am sure that this improvement has been largely due to the im-

proved position of the mandible and the resultant comfort. In referring back to my list of complaints I can say that practically all have ceased entirely."

CASE 4.—A man, aged 46 years, weight 240 lb., had a badly retruded mandible, very prominent lips, receding chin, sagging throat muscles, with much sinus trouble. The mandible was brought forward three millimeters and opened four millimeters through immediate maxillary denture and lower distal partial denture. There was less need for relief treatment than in the average case. There was no disagreeable systemic reaction; the patient's appearance, general health, and sinus condition were greatly improved. Facial tonus was restored through neuromuscular therapy. In his work he has been promoted twice within two years.

A.

Fig. 3, Case 4.—*A*, Pictures taken the same day in 1939, before and after initial treatment. (See case record for subsequent changes.)

CASE 5.—A woman 56 years of age had a badly retruded mandible and close-bite. Left head of condyle showed very prominently under skin in function. Hyoid bone inhibited in deglutition. The mandible was brought so far forward in this case after several weeks of preliminary muscle exercises, that it was hard to hold the position long enough to lock the trial plates for a new bite position. Taken from her own dental experiences which she wrote on completion of the work are the following words: "During the years from ten

to twenty I suffered from an inferiority complex. My lower jaw began and continued to recede and my chin became shorter. I looked carefully at each member of the family but could find no chin like mine. I practiced before the mirror and learned that an outthrust chin helped when I needed to carry a point.

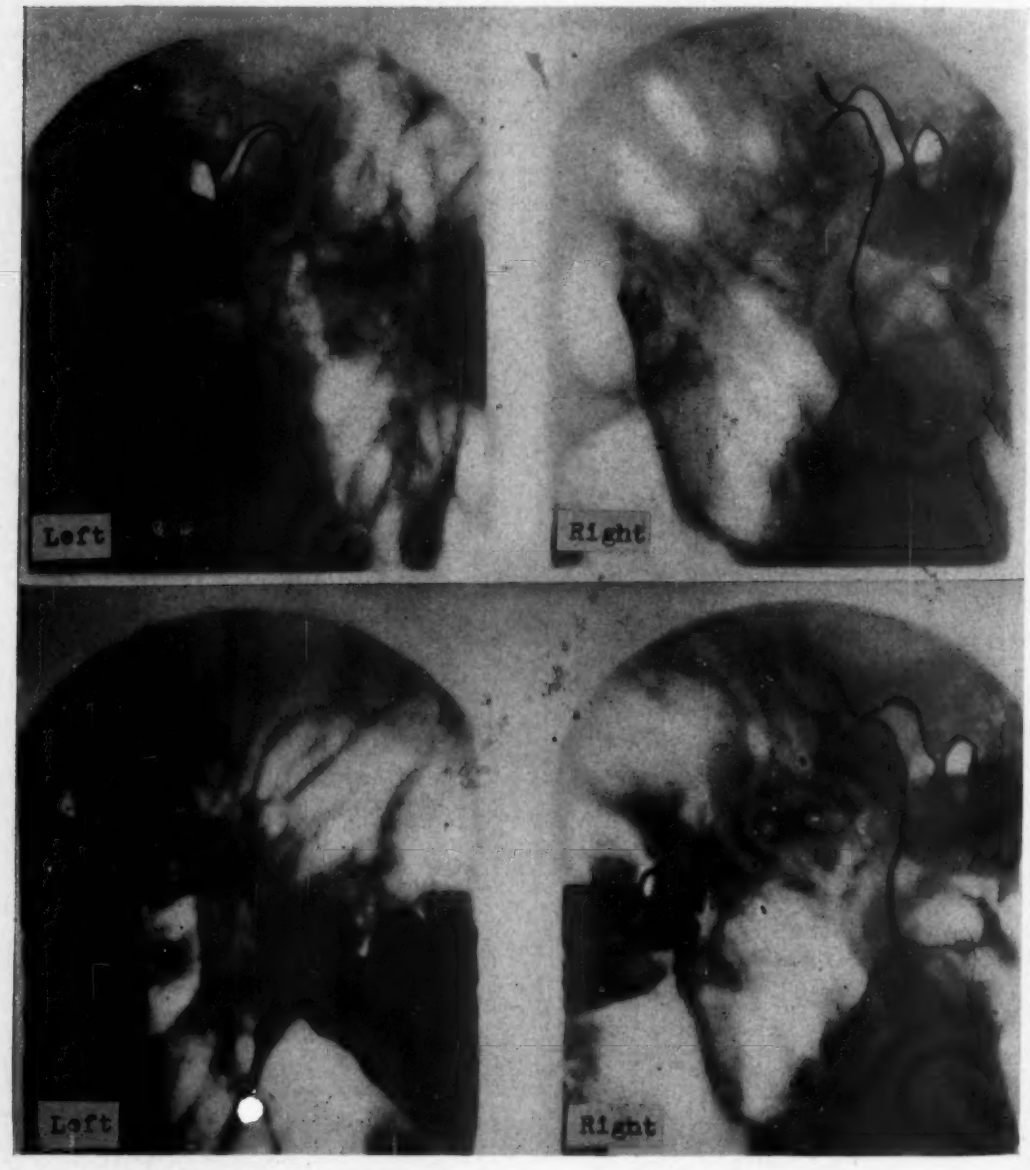

Fig. 3, Case 4.—Condyle x-rays of this patient taken the same day, *B*, before and, *C*, after. Patient never experienced any joint discomfort resulting from repositioning his mandible.

"By the time I was twenty my lower teeth kept striking at the roots of my upper teeth and I was continually having sensitive front teeth and sore gums. The right hinge of my jaw seemed so loose that on my frequent trips to the dentist for fillings the jaw bothered me more than the drill. When fifty years was reached, unhealthy and uncomfortable symptoms began to multiply. My lower teeth began striking harder at the roots of the upper

teeth causing inflamed and painful gums and slicing off the upper teeth with great rapidity. The hinge of my jaw bothered me more and more. I chewed my food inadequately. The act of swallowing was awkward. My throat at night was sore for no apparent reason. My sinuses were never free from mucus and all winter every cold wind caused trouble.

"First some casts were made; a couple of good strong molars on the lower jaw were seen to be impeding progress in either direction. When these were extracted my jaw began to move forward. While I was convalescing I did the prescribed exercises which loosened some of those muscles and strengthened others.

Fig. 4, Case 5.—Increased throat area in right view above vocal cords. Epiglottis is also exposed. Deflection of fundamental tones to back of pharynx has been reduced and voice volume accentuated by increased resonance from the basilar process of the occipital bone due to the enlarged area.

"During this period there were some interesting effects. For the first two or three days there was a considerable drainage from the sinuses. After the first few hours the unnatural feeling of the forward position of the jaw disappeared and the prescribed exercises were just enough to keep the face and jaw from feeling rigid. Soon the new bite felt so natural that once or twice a sense of collapse was experienced when the teeth were removed. This was of short duration owing to the rapidly strengthening muscles. My front teeth are no longer in danger of being sliced away, my gums are growing healthy. I swallow with less commotion. I no longer fear that my jaw will come unhinged. After several months of winter weather I have had no sinus trouble or sore throat. I can and do chew my food competently. That generally tired feeling returns but rarely, and I feel increasingly vigorous. I am looking forward confidently to doing very well for the next twenty-five years."

CASE 6.—A man 72 years of age was sent by Dr. Seaver having intermittent deafness in left ear and tinnitus. He was using full upper and lower dentures with such a close-bite that there was only a ten-millimeter space between his jaws. New dentures with a twenty-millimeter opening were inserted. At this time he could open his mouth only far enough for me to place one finger flatways between his teeth. At the end of two weeks I could place two fingers vertically in this space. His hearing improved, his tinnitus left him and his general health and appearance have improved. He is very appreciative.

CASE 7.—A woman 94 years of age had teeth in good occlusion with good color. She would not let me place a conspicuous filling as she did not want anything artificial to appear in her mouth. This case is mentioned to demonstrate that all mouths do not collapse with age.

A general survey of the occlusion in these above-mentioned cases demonstrates that the planes of occlusion have changed. Some have collapsed either anteriorly, posteriorly, laterally or bilaterally. These dentures are functioning on a rotated axis, either vertically, horizontally, or transversely, or in combination. Whatever the structural abnormality, harmony with function has been disturbed by these changes in mandibular posture.

SUMMARY

After thirty-five years in practice one naturally acquires a philosophy concerning the different specialties of dentistry. What then is the place of orthodontics from this background? Orthodontics is the branch of organology which deals with the oral organ. The methods necessary to assist nature to establish and maintain an efficient oral organ are: (1) by the use of technical appliances to determine and to supply the physical forces needed to stimulate structural changes, (2) by the practice of neuromuscular therapy to develop the vital forces necessary in normal psychosomatic functions.

CONCLUSION

All motion begins and ends with posture, and if the mandible is misplaced, nociceptive registration reacts harmfully on body tissues.

It is possible to determine, with the aid of scientific instruments, a bite plane which will coordinate with normal body mechanisms.

Centric relationship is adjustable in proportion to the skill of the operator in his diagnosis, and the technical ability required to harmonize his construction with metabolic processes.

Before postural correction is attempted, the patient must thoroughly understand the part volition plays in training the kinesthetic sense to maintain the mandible in its new position and to develop the synergetic control necessary for efficient function.

Appreciation of the value of dental services by both patient and operator is enhanced when corrective therapy is the method of treatment.

Nature cannot continue to compensate indefinitely to noxious body mechanisms of which a malpostured mandible is an example.

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THE NEUROMUSCULAR CONTROL OF THE MANDIBLE

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IN A study of the neuromuscular mechanisms controlling the mandible an extensive physiologic background is involved. To present such a background in a limited paper of this type would be like trying to know all about the game of bridge in one lesson. For this reason certain limited remarks will be presented, with the hope of stimulating your interest in its more detailed study, for the purpose of practical guidance in an approach to the corrective treatment of malocclusion.

The first area with which to become acquainted is the receptive field of the chewing reflex. In every well-recognized reflex of peripheral origin there is an area or field within which stimulation of its receptor organs produces a specific reflex response. The chewing reflex is one of them. The scratch reflex in the dog is another. Lightly pass the finger to move the hair gently in the foreshoulder region, and the hind leg responds with a scratch response, so long as this stimulation remains within the receptive field.

The receptive field of the chewing reflex consists of the skin and mucous membrane surfaces of the lips, cheeks, and tongue.

Resident in that receptive field, the two receptors to be kept in mind, in this study, are those for touch and for pain. Under normal conditions of occlusion the contacting of the jaws, with their dental complement, stimulates the touch receptors, and the reaction following is known as the tangoceptive reflex—a flexor reflex. Should the touch receptors be stimulated to an extent which would produce injury to the tissues, the receptors for pain would then be stimulated, and the reflex action would be one of quick, forceful withdrawal of the mandible, in order to get away from the harmful object. This reflex is known as the nociceptive reflex—also a flexor reflex. An example of this is seen when we step on a sharp stone with our bare feet; the injured foot is quickly flexed to withdraw it from the source of injury.

Both the tangoceptive and the nociceptive reflexes cause the jaw-opening (flexor) muscles to contract, the difference being one of adaptive purpose.

The receptors for touch and for pain located in the external surface are called exteroceptors and are distributed in what is known as the exteroceptive field of the chewing reflex.

Intimately associated with the exteroceptive field of the chewing reflex is that of the deep field, represented by the muscles, tendons, fasciae, ligaments, and periosteal tissue attached to the mandible and temporomandibular joints. Distributed throughout this field are receptors for muscle and tendon stretch. receptors for pressure and for pain.

Since they are located in the deep field, they are called proprioceptors, and the field itself, the proprioceptive field.

Read before the New York Society of Orthodontists, Nov. 10, 1941.

The stretch receptors are stimulated whenever the muscle is put on the stretch, by increasing its length between its origin and attachment, even by so little as eight-tenths of one per cent. The effect produced by muscle stretch is "postural contraction" of the muscle so stimulated, and this reaction is known as the muscle stretch or myotatic reflex.

It is of special interest and importance to know that there is a certain degree of stretch exerted on all muscles by their normal origin and attachments, particularly the antigravity or extensor muscles. This is easily demonstrated by cutting the tendon and witnessing its retraction, and the complete disappearance of tension. By reattaching the tendon to its former normal position, the tension will immediately reappear. Magnus has shown in this simple experiment that even the difference of a few millimeters is sufficient to cause the tension to disappear (Fulton).

A third factor affecting stretch is that if a muscle is stretched to an extent that injury to the muscle tissue is imminent, the pain receptors are stimulated, and a relaxation of the muscle results.

This basic factor of stretch, determining the degree of tension of a muscle under normal anatomic conditions, may reasonably be assumed to have a clinical application in explaining varying degrees of hypertension and hypotension found in the masticatory muscles under conditions of malposture of the mandible; for example, where the position of the mandible is retroposed to an extent that the normal relationship of muscular origin and attachment is shortened for some muscles, and lengthened for others. Also parts, within the same muscle, may have their tension altered for the same reason. In edentulous cases removal of the dentures and their replacement are gross examples of changes in muscle tension.

Analysis of the action of the central nervous system (C.N.S.) as it affects the neuromuscular mechanisms controlling the mandible should first be directed to the receptor organs, distributed in the receptive field of mastication. The reason for this is that in these receptor organs is traceable the initiation of the reactions of the nervous centers, which are located in the C.N.S.

Stimulation of the receptors for touch, stretch, or pain is conducted into the C.N.S., initiating there stimulation of its centers, which are the next to react, and the stimulus created there is conducted out of the C.N.S. to the effector organ (muscle).

This phenomenon is called a reflex, and the pathway over which it travels is a simple reflex arc.

Peripheral stimulation is conducted to the C.N.S. by an afferent neuron, and stimulation leaving the center in the C.N.S. is conducted by an efferent neuron.

This simple arc consists, therefore, of the following:

(1) A receptor organ, (2) an afferent neuron, (3) an efferent neuron, and (4) an effector unit (muscle).

The reflex arc utilizes the affector-effector or afferent-efferent system, which constitutes the peripheral nervous system.

It is now plain that the edifice of the whole C.N.S. is reared upon two neurons, the afferent root cell and the efferent root cell; that they form the

pillars of the fundamental reflex arc; and at the junction between these two is located the nervous system center, that is, the spinal center, or its cerebral equivalent in the brain stem (Sherrington).

Afferents from the mastication field enter the brain stem as sensory nerves of the fifth cranial or trigeminal nerve.

Efferents to the masticatory muscles leave the brain stem as motor nerves of the trigeminal (fifth cranial) nerve.

Sensory stimuli arising in any portion of the distribution of the trigeminal nerve utilize not only the motor nerves going to the muscles of mastication, but other motor nerves found in the seventh cranial nerve, going to the facial muscles, and certain muscles in the neck; motor nerves found in the twelfth cranial, going to the muscles of the tongue; motor nerves found in the ninth and tenth cranial nerves, going to the muscles of the pharynx and larynx; motor nerves found in the eleventh cranial, going to neck muscles, controlling the position and movement of the head.

Hence trigeminal reflexes may utilize muscles supplied by motor nerves found in at least six cranial nerves.

The lips, cheeks, and tongue play an important role in shuttling the food to and fro between the teeth during mastication similar to a hopper in a grist mill. The muscles of mastication, with those of the cheek and tongue, play an important role in the first act of swallowing, in conjunction with the pharyngeal and extrinsic muscles of the larynx. Even the diaphragm is momentarily inhibited (respiratory arrest) as the food passes by the glottis in its descent to the esophageal pouch.

We come now to the question: What controls the mandible when in the resting position? This is mediated by the jaw-closing muscles reacting against the pulling force of gravity, which is constantly threatening to upset the balance. Consequently, there is a continual contraction of a tonic type within the jaw-closing muscles, creating increased tension in those muscles to an extent sufficient to maintain the posture of the mandible.

The pull of gravity is the stimulus adequate to excite the stretch receptors in the muscle fibers. The stimulus travels over the stretch reflex arc, returning to the same muscle fibers and causing them to contract. The result of this action-reaction interplay keeps up a sustained tension, called muscle tonus.

Since the jaw-closing muscles counteract the force of gravity, they are called antigravity muscles, and antigravity muscles are extensor muscles. The point to be emphasized here is that it is from this postural position that movement of the mandible starts, and to which it returns. Therefore, posture is the basis of movement, and all movement begins and ends in posture (Wright). This fact is of paramount importance since it is the crux of the dynamic situation underlying the neuromuscular control of the mandible.

We now come to the question: What starts the movement of the mandible in the undeviated opening of the jaws? The answer is the contraction of the jaw-opening (flexor) muscles (the prime movers) with inhibition of the jaw-closing (extensor) muscles, the antagonists. In a voluntary muscular act those muscles whose contraction is essentially responsible for the movement of the part are called the prime movers or agonists, and those muscles which oppose the prime movers are the antagonists (Sherrington).

In the chewing reflex the first phase is contraction of the jaw-opening (flexor) muscles, with inhibition of the powerful jaw-closing (extensor) muscles. The second phase is inhibition of the jaw-opening (flexor) muscles and a quick contraction of the jaw-closing (extensor) muscles. This alternating reflex is repeated in a rhythmic manner operating on the principle of reciprocal inhibition of antagonistic muscles (Sherrington).

To visualize the play of reciprocal action between the flexor-extensor musculature, a comparison might be made to an archer and his bow, in which the bow would represent the extensor musculature and the string the flexor musculature. As the archer draws back the string (flexor contraction), the powerful bow is put under increasing tension, but prevented from acting (inhibition) until the string is released, when the bow reacts (extensor contraction) and returns to its former posture.

For clinical guidance there are in this study three reflexes which are outstanding, and they are listed in the order of their potency in an ascending order:

(1) The proprioceptive, (2) the tangoceptive, and (3) the nociceptive.

The muscle proprioceptive reflexes are least potent and give way to the tangoceptive; the tangoceptive, though more potent than the proprioceptive, give way to the nociceptive reflexes, which are prepotent over all others.

This is as it should be, for the proprioceptive reflexes are conditioning the muscles to be ready for action when initiated by the tangoceptive, and in this sense are secondary to the tangoceptive. The tangoceptive are free to function, so long as no injury to the tissues results. Should injury occur, the nociceptive take charge so long as any noxious factors are present, the purpose being protection.

How is the brain notified of all that is going on in the peripheral field by the stimuli coming from its receptors into the spinal center? This is accomplished by a system of ascending afferent neurons. Calling the peripheral afferent neuron as neuron one, neuron two ascends from the spinal center to the thalamus, a subcortical sensory center, and neuron three ascends from the thalamus to the sensory area of the cerebral cortex.

How does the brain control the spinal center? This is accomplished by the upper motor neurons with cell bodies in the motor area of the cerebral cortex.

These motor neurons descend from the cerebral cortex to the motor nuclei of the cranial nerves located in the brain stem, which are the cerebral equivalent of a spinal center. The motor nuclei represent the cell bodies of the lower or primary motor neurons which are the peripheral efferent neurons going to the muscle. In man it is in this way that the cerebral cortex, the new brain, has taken over the voluntary control of the spinal centers formerly located in the old brain, which is now represented by the subcortical centers.

In the cerebrum initiation of the reactions of the motor cortex are traceable to the receipt of stimuli from the periphery, causing stimulation of primary areas in the sensory cortex (somesthetic areas). By means of tracts of association fibers these primary somesthetic areas are linked together and thereby bring sensations of various types into relationship and combine them

into memory patterns of conscious experience. The somesthetic impressions enable other areas endowed with executive discrimination to determine the appropriate motor reaction.

The cerebrum informs the cerebellum of the motor activity it is initiating, and the cerebellum in turn modifies and regulates it.

From the labyrinth come tonic stimuli to the antigravity (extensor) muscles directly and at the same time to the cerebellum, which is also receiving muscle proprioceptive stimuli from the muscles, and in turn exerts a modifying control over the same muscles so that posture and movement will be smooth and orderly and graded to a desired degree. Absence of such control is typified by incoordination seen in the tabetic patient.

How do the afferent stimuli from the periphery, the descending stimuli from motor cortex, subcortex, and cerebellum, and stimuli from the labyrinth all manage to affect the lower or primary motor neuron going to the muscle? Is it true that they all meet at one place? Yes, they all meet at the cell body surface of the lower or primary motor neuron, the final common path to the muscle. Do they all go down this path at once or as fast as they arrive? No, they have to wait at this junction point called the synapse, since some of the stimuli are allied and some are antagonistic, and this is the way it is decided. The allied stimuli represent "plus signs" and the antagonistic represent "minus signs." If the total of the plus signs is greater than that of the minus, and of sufficient strength to overcome the resistance of the synapse, they will travel the primary motor neuron and stimulate the muscle to contract. Voluntary motor stimuli may arise in the cerebral cortex and are a powerful factor in the outcome of the plus signs winning out, or the minus signs winning out, at the final common path, the primary motor neuron leading to the muscle. For this reason unconditioned (unlearned or instinctive) reflexes may be brought under the control of the will and so become conditioned (learned) reflexes. If necessity dictates, conditioned reflexes may be reconditioned again and again.

This is the basis upon which neuromuscular training is made possible and is practiced in clinical medicine. If the relatively very complicated motor act of speech can be reconditioned, then it is reasonable to assume that neuromuscular training of the muscles controlling posture and movement of the mandible is attainable, for it is a far simpler procedure in correcting malposture and movement in cases of acquired malocclusion, than that involved in speech defects, i.e., stammering and stuttering.

DISCUSSION

The mandible, a movable part, is suspended by ligaments and muscles from the lateral and under surfaces of the skull and in turn shares in a somewhat similar support of the hyoid bone.

The ligaments act as guy lines, while the muscles represent both support and internal combustion engines.

The motor nerves to the muscles deliver the necessary ignition spark for combustion of energy material, stored up in the dynamic engines. The receptors in the peripheral fields are the percussion caps, and the neural components serve as conduction wires from the percussion caps to the engines and to the control centers in the C.N.S.

The muscles while maintaining the mandible in the resting position may be said to be in a tonic state of stable instability. This seems paradoxic, but it means that these dynamic engines are maintaining a readiness to respond, with movement of the mandible in any direction, in obedience to reflex stimulation.

The resting posture of the mandible in all three planes (sagittal, horizontal, and transverse) may be said to be determined by the reflex balance existing between the jaw-opening and jaw-closing muscles.

From clinical observation and for physiologic reasons, it appears that the mandibular complement will seek that position while resting, which is easiest to be maintained, and, when functioning in chewing, will contact the maxillary complement where it is mutually most comfortable to do so.

This is following the well-recognized pleasure-pain principle, which determines the behavior of the individual as a whole.

The effect of a persistent single noxious factor is capable of influencing the neuromuscular mechanism of the mandible to move away and re-establish a new location from which to posture and perform movement. So long as the noxious factor persists, the new location will be a pivotal point for functional activity, and a compensatory balance will be maintained—a functional adaptation.

In the case of multiple noxious factors the neuromuscular mechanism will cause the mandible to seek a position of least injury, but meanwhile the force of the muscular action will be decreased, consistent with protection of the contacting parts. This represents functional adaptation and, in time, will be accompanied by structural changes, also an adaptation. Noxious factors may be present and active, without necessarily registering in the brain as pain. They may be of an intensity to arouse pain, the result of a mental perception, and interpretation of a harmful process. The practical point here is that if we are guided by pain only, many noxious factors will be overlooked.

The energy cost in maintaining balanced posture of the mandible is relatively low. The energy cost in maintaining unbalanced posture (malposture) is relatively high. Normally, 85 per cent of our total energy is expended in maintaining the bodily functions, leaving 15 per cent with which to do the world's work. Therefore, the greater the addition to the normal overhead cost, the less there is of available energy with which to do our work. This added overhead cost is reflected throughout the entire bodily activity, and its accumulative effect is very much greater than just the local effect would suggest.

In malocclusion potential injury is imminent, and actual injury is frequent, necessitating an aroused and now hypersensitive nociceptive reflex activity, resulting in an increased tension in both the flexor and extensor muscles, with a definite limitation of movement. In this protective reaction nature is using the musculature as partial splints and may, in acutely painful conditions, actually limit the motion entirely, by locking the jaw in a state of trismus.

A state of partial trismus might well describe the condition of partial inhibition often seen in cases of malocclusion.

Another factor which should be given consideration in acquired malocclusion is the question of whether changes in muscle tension occur as a result of changes in the normal relationship of muscular origin and attachment, which presumably happen when the mandible is postured backward, forward, or laterally. Clinically, there appears to be evidence in certain instances that

such changes in tension do occur, and to affect appreciably the coordination of the masticatory, facial, and tongue muscles as an allied group. Also the orderly succession of the swallowing and breathing reflexes which follow, appear in certain instances, to display episodes of incoordination, resulting in choking spells—"the food went down the wrong way" kind of experience.

As an otolaryngologist I have frequently observed that aeration of the middle ears has been inadequate in malocclusion cases. The eustachian tube muscles and those within the middle ear are intimately related in this chewing and swallowing reflex activity.

The point which I wish to bring out is that in acquired malocclusion the *abnormal changes in anatomic relationships* affecting muscle tension and the *trigeminal nociceptive reflexes* are the two factors of outstanding importance in the basic disturbances of functional activity, in which the mandible is the movable part.

Since the primary stimuli arise in the peripheral field, where reside the exteroceptors and the proprioceptors, and, in the case of the chewing reflex, that part of the peripheral field which is known as the receptive field for this particular reflex, it is then in this particular area that search should be made for evidences of injury to the tissues. Such evidence many times is perfectly obvious, and again not so obvious, but still it is there and readable by the trained observer.

It is known that acquired malocclusion is attended by structural and functional adaptations. It is my belief that functional adaptations are determined by basic physiologic laws determining purposive behavior, and that structural changes are largely secondary to the functional. Since man is a dynamic psychosomatic unit, it follows that functional adaptations involve both the somatic and the psychic fields. Of importance in the psychic field are the conditioned reflexes. They consist of cortical sensori-motor memory patterns, learned from past experiences of the individual, and now determine future behavior when similar conditions recur.

At the moment a physiologic working concept in the approach to the study of malocclusion is needed, and it should, in my judgment, be broad and flexible and applied with an open mind, for at best our knowledge is fragmentary. Although it is fragmentary, it should be carried forward for its own sake and improved upon as a truer understanding reveals itself.

At the moment the working concept which has helped me as an otolaryngologist, working in conjunction with the dentist, is as follows:

Proprioceptive reflexes regulate posture, the basis of all movement, and give way to tangoceptive reflexes which initiate and direct movement so long as no injury to the tissues results.

If and when injury to the tissues occurs, the nociceptive reflexes take protective control and, by virtue of inhibition, alter both posture and movement with functional and structural adaptations.

When there is normal occlusion, there is automatically normal posture and normal movement. When there is malocclusion, there is automatically malposture and malmovement (dyskinesia). The cerebellum is the coordinator and moderator of posture and movement.

The cerebrum is the interpreter and executive director with relative supreme control over all, capable of conditioning instinctive reflexes and reconditioning previously established conditioned reflexes.

In the approach to the correction of acquired malocclusion, first, search for and relieve all noxious factors in the peripheral field, i.e., the receptive field of the chewing reflex; second, re-establish normal anatomic muscle relationship in all three planes; and third, recondition the sensori-motor cerebral field by corrective neuromuscular training to re-establish and maintain balanced occlusion.

SUMMARY

The neuromuscular mechanism controlling the posture and movement of the mandible has been considered in a limited manner, with emphasis on certain values which demonstrate the necessity of utilizing a physiologic basis in the approach to the study of normal dental occlusion and acquired malocclusion.

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CLASS I MALOCCLUSION COMPLICATED BY A MANDIBULAR CONTRACTION, AN IMPACTION OF THE MANDIBULAR FIRST PREMOLAR AND A MAXILLARY PROTRUSION

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THIS is a case report of two brothers; one had undergone treatment and the other was merely under observation.

In October, 1935, after I had been with Dr. Milo Hellman just about four years, this case presented itself. It was a Class I type of malocclusion. I do not know whether I was correct in the use of terms when I described the case in my title, but I tried to conform to the terminology generally used in orthodontic literature. I would rather have said that it was a Class I malocclusion (Fig. 1), with protrusion of the maxillary anterior teeth, a very deep bite, a crowding of the mandibular dental arch, and an impaction of the mandibular right first premolar. It might be called by many of you a maxillary protraction or a mandibular retraction, or as I called it a mandibular contraction. I want to emphasize the fact that the molars were in correct mesiodistal relationship. The age of the patient was 11 years, 5 months. The stage of dental development—IIIC bordering on IVA according to Hellman—was ideal for a male to begin treatment.

From the different case reports I have read, I find that it is customary at this point to discuss etiology. There is no history of thumb-sucking, finger-sucking, nail-biting, or any other of the pernicious habits which may have a bearing on etiology. However, the complete crowding out of the mandibular premolar may lead one to believe that premature loss of the deciduous teeth and lack of space maintenance in that area might have been a factor in etiology, but since I have no record of the early stages of the development of this dentition, I cannot say whether that is so. There is, however, a hint of some complication that existed in that area at an earlier age. The parent tells me that about a year or more previous there was some swelling and inflammation in that region, which made it necessary for an exodontist to remove some tooth or teeth. Whether they were deciduous or supernumerary teeth is not known. This is all I can say about etiology. However, I will use the remark often made by Dr. Hellman, after a brief discourse on the various phases of etiology to a parent who wants to know what caused the child's crooked teeth, which ends up with the statement, "I cannot tell you what is the cause, but I do know what to do about it." Having imbibed as much of Hellman's principles and technique as was humanly possible at that time, I had hoped that I did know what to do about it.

Read before The New York Society of Orthodontists, Nov. 11, 1941.

As I had been trained by Dr. Hellman in the use of labial arches and wire ligatures, I proceeded to construct my appliances. The molar bands and maxillary labial arch were first constructed by the indirect method on a model. The molar bands were cemented in place and an impression taken for a bite plate. Because of the limited time, the details of the construction of the bands, the labial arch, and the bite plate will not be discussed at present. I have demonstrated them at the various table clinics which I have presented.

The patient was instructed to wear the bite plate all the time, except when eating or cleaning the teeth. The maxillary labial appliance was not inserted at the time, but was kept in readiness for a future date. My general plan of treatment was to open the bite, improve the shape of the maxillary dental arch, bring the maxillary central incisors slightly back, and expand the mandibular dental arch considerably to correct the crowding and make room for the impacted premolar. The case as you see it resembled a Class II, Division 1 type of malocclusion, but the mesiodistal relationship of the molars was correct. When the bite was sufficiently opened after the plate had been worn about two months, until about the middle of January, 1936, the mandibular labial appliance was constructed and inserted. The maxillary labial appliance was also inserted, and the patient was seen every week during which time one of the appliances was alternately removed, a prophylaxis performed, the appliance adjusted, and then replaced.

Fig. 1.—H. G., male, aged 11 years, 5 months, 2 days, before treatment was started, taken Oct. 24, 1935.

One of the problems was to get expansion of the mandibular dental arch without moving the mandibular molars back and thereby producing a Class II case. This was accomplished in two ways, first by the use of intermaxillary elastics at varying periods, dependent on the need as it presented itself. The other was by ligating the mandibular first molar on the left side to the first premolar, and on the right side to the second premolar. This was done by the

use of a lingual extension soldered on the lingual surface of the molar bands extending from the second molar to the second premolar. The mesial end of the extension had a knob on it. This knob was used to twist a wire ligature around it, and then the ligature was carried through the embrasure between the first premolar and cuspid, and tied to the labial arch. Because of the absence of the first premolar on the right side, the lingual extension was not carried to the second premolar but was ended at the mesial border of the molar band. Before the spur of the lingual extension was soldered to the band, a hole was provided for at the mesial end. This hole was used to thread a wire ligature through it and then carry that ligature around the second premolar to the labial arch.

Expansion of the mandibular arch was accomplished by soldered stop spurs in the molar area. A little piece of .020 gauge wire was soldered on the arch each time expansion was indicated. After much patient and careful manipulation of the appliances, I finally got the result seen in Fig. 2. It shows the case on Aug. 13, 1937, about a year and ten months after treatment was started. You will note that the maxillary dental arch was rounded out, the mandibular dental arch was expanded, and room for the first right mandibular premolar was created. The space as you see was even wider than necessary, but that had to be done to allow for the eruption of the premolar which was tilted mesially. Some of you may criticize the mandibular incisors. They are still a little crowded and seem to flare out, but since I felt the patient had enough of active treatment at the time, I then proceeded to construct a lingual retainer for the mandibular dental arch.

Fig. 2.—H. G., male, aged 13 years, 2 months, 21 days, after one year and ten months of treatment, taken Aug. 13, 1937.

Briefly this is the way it was done. The buccal tubes of the mandibular molar bands were removed and hooks soldered in their place to provide for intermaxillary elastics if needed. Bands were constructed for the mandibular cuspids. The lingual retainer was fitted snugly to the lingual surfaces of all

the mandibular teeth ahead of the molars. In the molar area it was fitted into small horizontal tubes soldered on to the lingual surface of the molar bands. In the cuspid area spurs from the lingual surfaces of the cuspid bands fitted into grooves on the retainer. In this manner the lingual retainer was supported at four points, at the two molars and at the two cuspids. *The supports were not fixed joints.* There was individual mobility of the four teeth supporting the retainer to allow for natural function during mastication. . The purpose of this retainer was to prevent a collapse of the mandibular teeth and was fixed only to prevent the teeth from drifting back to their original position.

To prevent a collapse of the maxillary dental arch, a plate was constructed without a bite plane and without any wire at all. It was retained in the mouth by grooves in the molar areas to accept lingual spurs on the maxillary molar bands. The plate was made to hug the lingual surfaces of the maxillary teeth. To provide against a protrusion of the maxillary incisors, the patient was instructed to insert the maxillary labial appliance at night only, with intermaxillary elastics from the maxillary cuspid area to the mandibular molars. The plate was also worn at night only. The intermaxillary elastics not only retained the maxillary incisors, but also prevented a backward drifting of the mandibular molars which might have been caused by the pressure of the crowding tendency of the mandibular anterior teeth.

Fig. 3.—H. G., male, aged 15 years, 1 month, 29 days, after further treatment and retention, taken July 21, 1939.

The case was retained as described till May, 1938. At that time the mandibular right first premolar did not seem to erupt, and I decided to institute more expansion. The mandibular lingual retainer was removed, and the labial mandibular appliance was reinserted. At the same time "T" spurs were used to get root movement of the mandibular incisors. The maxillary appliance, intermaxillary elastics, and the maxillary plate were continued to be worn at night only. Finally by July, 1939, the result shown in Fig. 3 was obtained.

I was satisfied with the result. The patient and parents were satisfied. I know there was an esthetic improvement as a result of my treatment. I earnestly believe I improved that dentition. Some of you might still criticize the mandibular incisor area. You might point out that the teeth are still crowded and that you could have done better with an Angle edgewise arch, a Johnson twin arch, a lingual appliance, or even an Atkinson appliance. Some of you might even criticize some of my procedures. But if you can show me a better result or even one just as good, I will credit you with the proper ability as a technician, regardless of what appliance you used. I regard your appliance of no more importance than the scalpel or any other complicated instrument used by a brain surgeon in a delicate operation. For the time being let us keep the result of this case in our minds and proceed to examine the dentition of this boy's brother.

Fig. 4.—D. G., brother of H. G., male, aged 6 years, 10 months, 9 days, taken April 16, 1937.

In April, 1937, D. G., the brother of H. G., presented this problem (Fig. 4). He was 6 years, 10 months of age. His dentition was retarded. The maxillary and mandibular first permanent molars were only beginning to erupt. But something tragic had happened. Due to neglect, it became necessary to remove the mandibular left first and second deciduous molars. There is absolutely no excuse for this. It should have been prevented. A problem was thus created, and with the dentition of his brother staring us in the face, there was every reason to believe that we were heading for trouble. A space maintainer seemed very much indicated there. You could definitely sell me a space maintainer in this case. All you would have to do is show me the casts of his brother before treatment was instituted and point out that this is what would happen if the space is not maintained. Frankly, I do not know how you would proceed to construct a space maintainer in this case with the permanent first molar not yet erupted. I assume you would first wait for the molar to erupt and then construct some appliance to maintain the space. However, since it has been my experience to learn that the promiscuous insertion of a space maintainer after

deciduous teeth have been needlessly and carelessly allowed to reach the stage when extraction became necessary, is adding insult to injury, I decided to do nothing and put the patient under observation.

By March, 1941, this is what had happened (Fig. 5). D. G. was then 10 years, 9 months of age. Instead of being retarded in dental development we find him now advanced in his dentition. In the mandible he has all the permanent teeth present except the second premolars, excluding of course the second permanent molars. In the maxilla we find the dentition also not retarded. Let us see what happened. The left mandibular molar area where the deciduous teeth were lost prematurely is developing very satisfactorily and is no cause for worry. An x-ray checkup shows the second premolar erupting normally without any interference. However, the right mandibular second deciduous molar is still present and is a potential source of trouble. It has not been shed and is being depressed by the eruption of the first permanent premolar in front of it and the first permanent molar behind it. I ordered the extraction of the deciduous molar after an x-ray checkup to determine the presence of a permanent successor. I consider this dental operation the best form of preventive orthodontics. A careful study of this condition gives us a clue to what may have happened to his brother in the same area. There is a possibility that a similar condition existed there, but nothing was done about it until it was too late. Inflammation and pathology were the result according to the history given by the parent. Good dentistry properly timed was the best form of preventive orthodontics in this case.

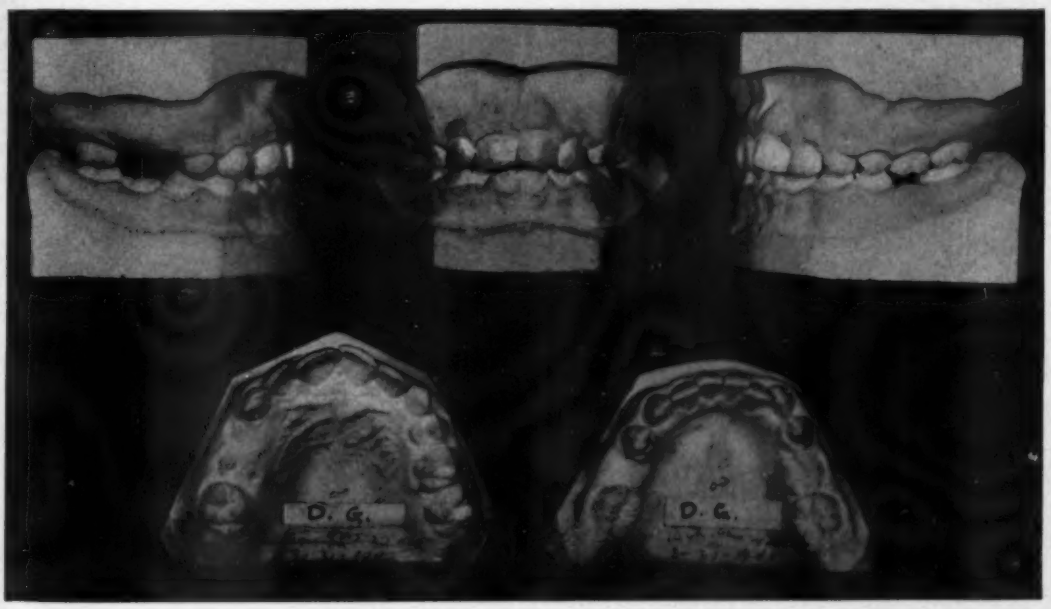

Fig. 5.—D. G., brother of H. G., male, aged 10 years, 9 months, 24 days, without treatment or space maintainer, taken March 31, 1941.

Let us further examine the mandibular arch of D. G.'s dentition. On the side where the deciduous molars were prematurely extracted and no space maintainer inserted, the alignment is better than on the other side where the deciduous molar is still present. Some of you may argue that orthodontic regu-

lation is indicated in this case, but it is my hope and belief that with the extraction of the deciduous right mandibular molar, this boy will go through life with a better dentition without mechanical interference than his brother will with successful treatment.

Fig. 6, in the upper left corner, shows the profile of H. G., the older boy, before treatment at 11 years, 5 months of age. In the upper right corner is a profile of the same boy after treatment at the age of 17 years. The picture below is a profile of the brother, D. G., at 11 years of age. A comparison between the profiles of the two brothers at 11 years of age shows a marked family resemblance, yet they are two different types of faces. H. G. shows a retruded chin; D. G. shows a good chin. H. G.'s profile would be classified by Hellman as a sub or minus normal face which was always associated with a Class II type of malocclusion, and D. G.'s profile would be classified by Hellman as a normal face which was always associated with a normal occlusion or a simple Class I malocclusion.

Fig. 6.—*A*, Profile of H. G., aged 11 years, 5 months, before treatment was started. *B*, Profile of H. G., aged 17 years, after treatment. *C*, Profile of D. G., aged 11 years, no treatment.

In spite of what I considered a good orthodontic result, I did not grow any chin for H. G. As a matter of fact the chin looked worse when I got through. Of course, you could argue that my technique was wrong. You could tell me that by making a gnathostatic model you could have better related the occlusal plane to the Frankfort plane and thereby diagnosed your case better; and then by using an Angle ribbon arch you could have gotten bodily and root movement of teeth, or you could have used a Johnson twin arch or an Atkinson

appliance and moved molars backward, or a lingual appliance and gotten a better result. Regardless of the different appliances that may be advocated by others, I could obtain the same result with the appliance I use, if I felt the procedure was justifiable. I did try to grow chin by bodily and root movement of teeth. If I wanted to, I could move a tooth bodily until I moved it out of its socket right through the alveolar process, but would that grow a chin? Would that have changed the pattern of facial growth of H. G. to that of D. G.? I even tried to use as glibly as many of us do such terms as lateral growth, vertical growth, maxillary protraction, mandibular retraction, moving maxillary molars backward and moving mandibular molars forward, and then I added to that a good deal of wishful thinking, but I could not grow a chin. I did, however, get a good orthodontic result, and I honestly feel I have benefited the patient from an esthetic viewpoint and from that of a functional improvement of the dentition.

Fig. 7 shows the x-rays of the teeth before treatment was started. Note some of the undeveloped roots and the mandibular third molar area. Fig. 8 shows the x-rays of the teeth after treatment. There is a problem of the mandibular third molars which may have some relation with the crowding of the anterior mandibular teeth and the pattern of facial growth. But will the removal of the third mandibular molars prevent or help to correct the crowding of the mandibular anterior teeth or will the removal help to grow a chin? Note the changes in the root ends of the maxillary incisors and especially in the mandibular incisors. I had good control of my appliance, and I was very careful in my technical procedures; but there are certain undesirable changes in the root ends of some of the teeth. They are not so bad considering the amount of tooth movement that was necessary in this case, but there is a little root resorption. I would like those of you who insist on growing bone by extensive bodily tooth movement to consider these changes carefully.

Fig. 9 shows in the upper row the progress made in expansion for the eruption of the mandibular right first premolar. The first x-ray was taken on Aug. 14, 1936, about a year after treatment was started. The second x-ray was taken on Feb. 5, 1937, six months later, and the third x-ray was taken on Feb. 28, 1938, during the period of retention. The lower row shows a series of x-rays of the mandibular incisors from the time before treatment was started to the time after treatment was completed. The first picture was taken on Aug. 27, 1935, before treatment. The second x-ray was taken on Aug. 14, 1936, about one year after treatment was started, and although a good deal of tooth movement was accomplished, there is no apparent change in the root ends. The third x-ray was taken on Feb. 28, 1938, during retention and shows slight changes in the root ends. The fourth x-ray was taken on Aug. 14, 1940, after treatment was completed and shows some additional changes not too extensive as yet, but threatening if further treatment was attempted.

Fig. 10 shows the case of a boy 11 years, 6 months of age with the maxillary first premolar crowded out. The maxillary first molar drifted forward. At first glance premature loss of deciduous teeth and lack of space maintenance could be considered as the cause of this condition but an x-ray of the area reveals that an overhanging filling obstructed the eruption of the first premolar

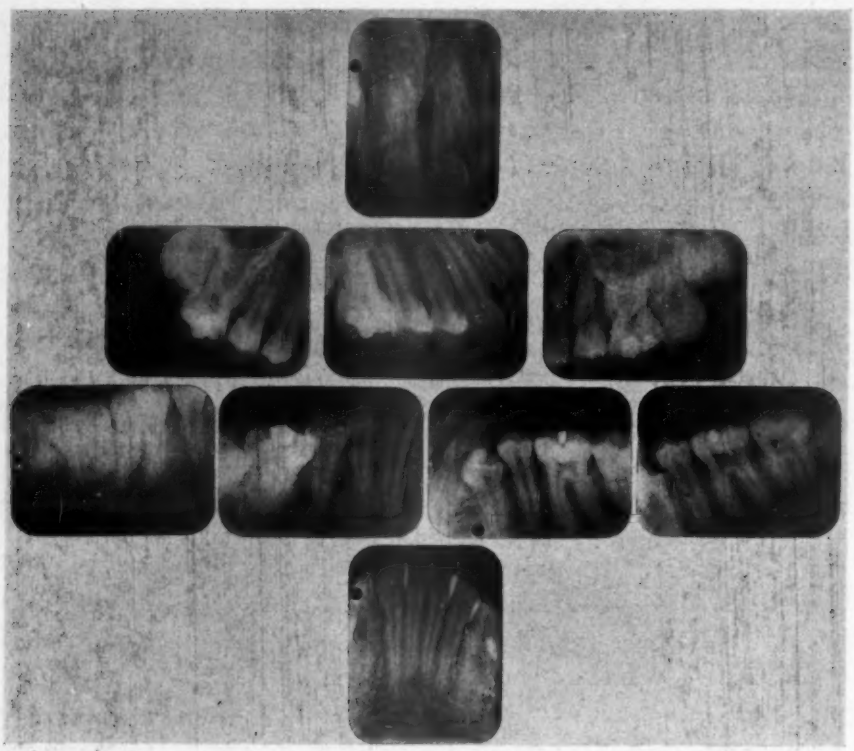

Fig. 7.—X-rays of teeth of H. G., taken Aug. 27, 1935, before treatment was started.

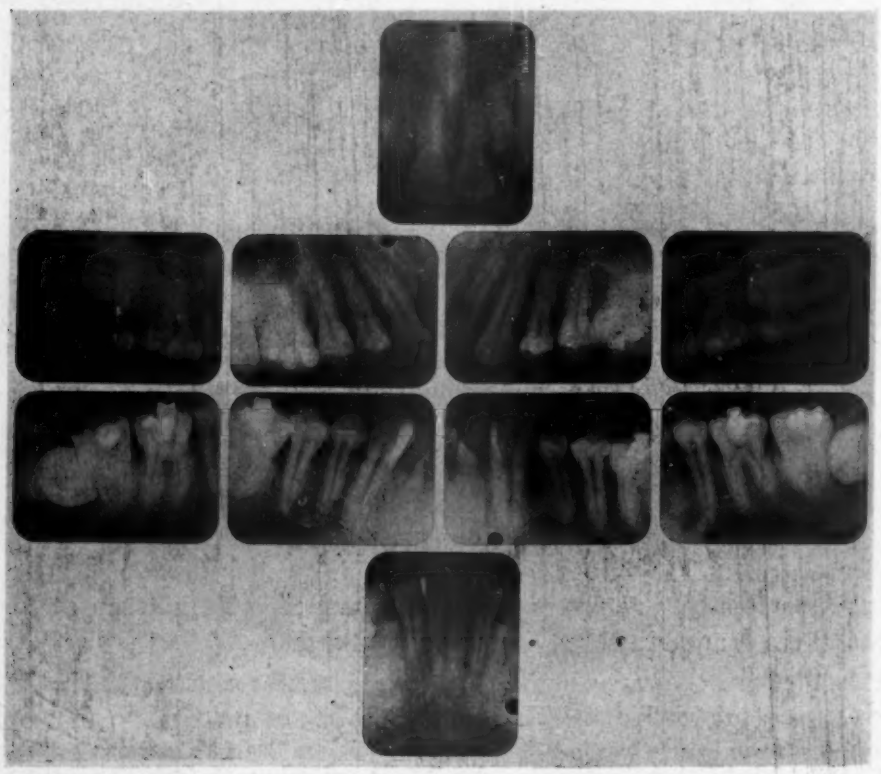

Fig. 8.—X-rays of teeth of H. G., taken Aug. 14, 1940, after treatment.

and allowed the mesial drifting of the first molar. The overhang of the filling was removed by the use of a disk, and the patient was dismissed. Two years later the second premolar erupted, and the first molar drifted back to the correct position without any treatment. In this case the poorly finished filling was the

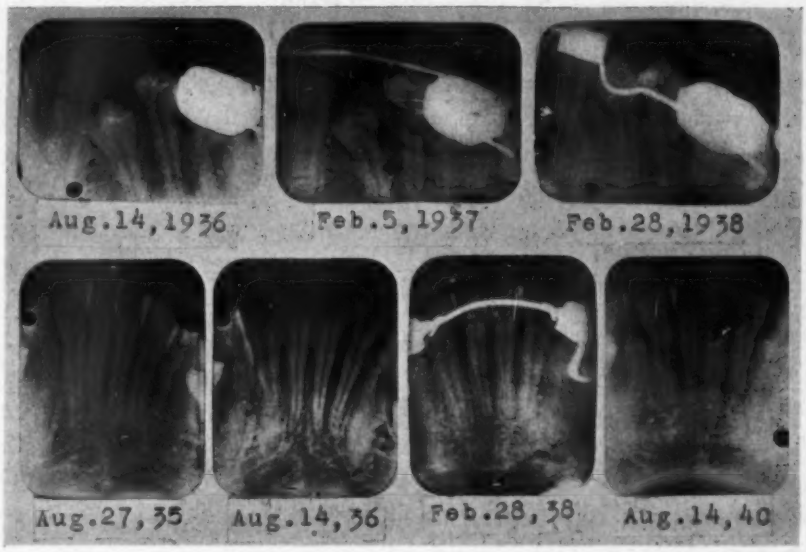

Fig. 9.—X-ray series, upper row showing progress made in opening space for impacted premolar and lower row showing changes of mandibular incisors during and after treatment.

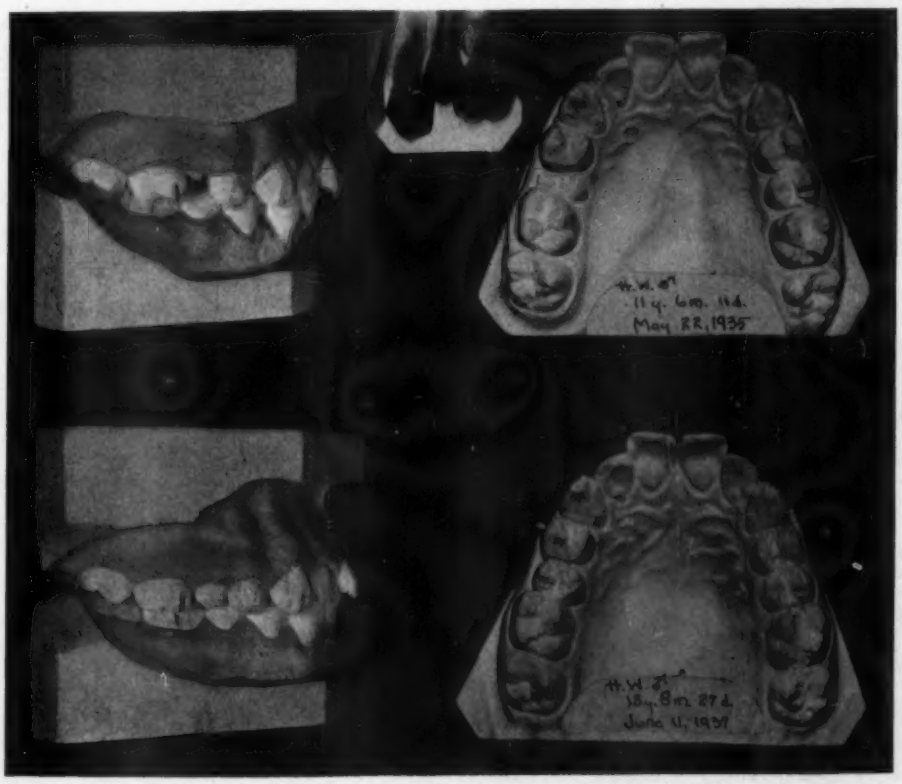

Fig. 10.—Overhang of filling of first premolar prevented eruption of second premolar with resultant mesial drift of the first molar. Bottom casts show result after overhang of filling was removed without any orthodontic treatment.

cause of the malocclusion, and with the removal of the overhang (the cause) the cure or correction was accomplished. Again good dentistry is the best form of preventive orthodontics.

CONCLUSION

I have tried to illustrate my interpretation of Hellman's principles and technique, and because of the limited time for my presentation, I had to be as brief as possible. However, there is one thought I desire to leave with you. It is this: There are many problems in our specialty today that require our solution. They could be conveniently divided into three categories as follows:

1. The problems concerned with dental development.
2. The problems concerned with facial growth and manifestations of facial differences.
3. The problems concerned with technique and the manipulation of the appliance or appliances used in orthodontic therapy.

These problems are definitely interrelated with each other from one category to another. Yet, in spite of their interrelationship they have individual characteristics which belong solely to their own category. In other words, you cannot solve a problem which concerns facial growth and facial differences only, with the appliance and technique used in orthodontic therapy; nor can you solve a problem of technique which concerns the orthodontic appliance alone with anthropometric methods and instruments. Practical orthodontics consists of a solution of the problems within these different categories, by the use of all the instruments at our disposal, and a proper relating of the problems to each other in the individual case under treatment.

I wish to acknowledge with thanks the aid given me by Miss Edith Hellman in the photography that was necessary to show the profile of the older boy before treatment was started, and also the photography necessary in the preparation of the last figure. Most important, I wish to express my respect for and appreciation of my recently terminated years of association with and training given me by my preceptor and teacher, Dr. Milo Hellman.

30 West 59th Street

THE UNIVERSAL APPLIANCE AS PRESENTED BY DR. SPENCER R. ATKINSON

GEORGE F. BOWDEN, D.D.S., DENVER, COLO.

THE universal bracket is patented and the majority of the other essential parts are either patented or are in the process of being patented. The patents covering these attachments are owned outright by the California Insitute Research Foundation.

The purpose of patenting this material was to give funds for research in orthodontics. The research is to be carried out at the California Institute of Technology. The research work is to be done in metals, rubber, cement, and in the field of biology. At this time an experimental biologist of the Department of Biology of the California Institute of Technology, Dr. Horowitz, is devoting his entire time to work in biology. The expense of this work and Dr. Horowitz's salary, for the first year, are being defrayed by the School of Dentistry of the University of Southern California. Royalties from the patents covering these orthodontic materials are being set aside to meet these expenses, next year and thereafter.

Dr. Atkinson does not receive any royalty or any discount from the manufacture of any of these items under patent. All these inventions are simply his contribution to his profession. Right here I feel that I ought to state that I and all the men over the country who use this type of appliance, certainly do owe Dr. Atkinson a great debt of gratitude for his untiring effort and his gracious kindness in giving the information he does, to all who seek it.

There are two principal reasons for the origin and formation of the so-called universal appliance. The first one is based on the anatomic construction of the maxilla and the mandible. On both maxilla and mandible the cortical layers of bone lie very close to the root surfaces of the maxillary and mandibular incisors, cuspids and premolars. There is little marrow substance around the roots of these teeth between them and the cortical layer of bone; especially is this true on their labial and buccal surfaces. This allows very little movement of these teeth in a forward direction before the hard cortical layer will be encountered. Cortical bone is dense and hard with a poor blood supply and, therefore, does not lend itself readily to any changes in its shape and structure. More often instead of the change for the better, we see knife edge gingiva, or its loss entirely, part way down the labial surface from misapplied force in the incisor and premolar regions, simply because this frail cortical layer of bone cannot make the readjustments it has to make if much movement of teeth in these regions is done.

In the molar regions the situation is different especially so in the maxillary molar area. However, the same situation will prevail in the mandible on the

Read before The Rocky Mountain Society of Orthodontists, October 22, 1941.

buccal surface of first molars if they are allowed to move forward too much, for then the mesiobuccal surfaces of the roots of these teeth will be into cortical bone. The incisors and cuspids exhibit the same limitations.

Because of the arrangement of bone about the teeth in the various parts of the maxilla and mandible, that we expect to be affected by our efforts in treatment, it is most necessary that we preserve our anchorage, which is this cortical layer of bone, and endeavor to do our work in the marrow spaces which have a good blood supply and, for this reason, will be able to lend themselves more readily to our efforts. This briefly outlines some of the anatomic considerations upon which the application of force in the use of the universal appliance is based.

The second is a mechanical one. Previous to the advent of the universal appliance, all movements of the teeth, rotation, torquing and expansion, were generally accomplished by means of one arch or bar extending from first molar to first molar on the labial and cheek surfaces of the teeth. Often this arrangement caused unwanted movement in some teeth during treatment because of some unlooked-for reaction. It was logical, then, to think of using several smaller arches or wires, instead of one large one, to accomplish this work. The use of several small wires instead of a large one to accomplish rotation, torquing and expansion, gives the advantage of better control and increased simplicity of operation. In the universal bracket there is a combination of the vertical slot first used by Victor Hugo Jackson in 1886 and later by Edward H. Angle for his ribbon arch; and a gingival slot opening buccally that is similar to that in the open tube or channel bracket, used by Calvin S. Case in 1910, and later by James D. McCoy in his open tube bracket, and by Edward H. Angle for his edgewise arch wire. The ribbon bracket is used for rotation and torquing the teeth, and the gingival slot, or open tube part, for uprighting the teeth, if their crowns lie either mesially or distally to the vertical position. Thus with these forces being divided, either one or both of them may be employed at one time, if necessary, which makes control of their action and reaction simpler.

The discovery of chrome alloy permits the use of very small arches or wires, due to its great strength. This allows a very gentle stimulus to be applied to the teeth and closely resembles growth. This type of bracket permits a controlled gentle force for the parts of the arch which require gentle manipulating during their movement.

The molars being larger and more favorably situated in their bony support are controlled solely by a large lingual wire of 0.030 of an inch in diameter. If additional force seems necessary in the premolar and cuspid regions, auxiliary springs to these parts are incorporated into the lingual arch as an integral part of it. Due to its size no breakage or distortion occurs as it does so often when smaller springs are used. With separate control of the molars by the lingual wire, it further serves to break up the force and effort required of the original large diameter labial arch wire, referred to above, as no control of the molars is expected or demanded of the labial wires.

This bracket may be used with any type of well-fitting bands. Brackets are placed in the center of the bands mesiodistally. The molar bands have two attachments. One on the buccal surface over the mesiobuccal cusp on the

maxillary and mandibular molars called a double buccal lug. On the lingual is a sheath which fits an 0.030 wire doubled upon itself. The lingual sheath may be placed on the band in either a vertical or horizontal position as you choose. The lingual arch may be constructed indirectly on a stone model, or directly in the mouth.

This appliance has been called the universal appliance, which is incorrect. The word "universal" refers only to the bracket used on the incisors, cuspids, and premolars, and it does give universal control of the movements of these teeth. The term "universal" implies that the appliance is, or can be used on all types of malocclusions, which is not entirely correct either. The most efficient operation of it requires all the teeth to be present and banded, if you expect to get all the various movements possible to be obtained, out of the appliance. Many times this is not necessary so it does not have to be always used as a full banded appliance. On mixed dentures with wide spaces present between teeth, the light wires will be distorted and rendered useless by the forces of occlusion during mastication. This can be handled by the use of the lingual wire with auxiliary springs and the use of the universal bracket on approximating teeth that permit its use in segments of an arch.

With your knowledge and experience I feel sure you will be able to consider the merits of this appliance upon the basis it has been presented.

1107 Republic Bldg.

TWIN-ARCH ADJUSTER

MAX J. FUTTERMAN, D.D.S., NEW YORK, N. Y.

IN ADJUSTING the twin arch to the mouth we frequently find that we have not accurately gauged the distance between the mesial ends of the end sections. This often necessitates a trek back to the laboratory to reinsert the appliance in the vise to pull the end sections apart. To obviate this running back and forth, I have designed a twin-arch adjuster which can be used to make the necessary corrections at the chair. I have found this instrument most helpful. It is made basically of a large inside caliper, with the outer knob removed, another larger

Fig. 1.

Fig. 2.

Fig. 1.—Twin-arch adjuster.
Fig. 2.—Twin-arch adjuster, showing minimum opening of beaks when compressed.

Fig. 3.—Twin-arch adjuster, with appliance in position. By turning the knob to the opposite side, the arms are pulled apart, carrying the end sections with them.

knob constructed and placed between the arms. The ends of the calipers have been cut down, and openings sufficient to hold the end sections have been cut into them. A millimeter ruler, with one end fixed, has been attached to one of the arms, while the opposite arm supports the free end of the ruler as the accompanying photographs illustrate. When the twin arch is placed into the compressed calipers, the calipers upon the release of the tension will hold the arch extended to the full length of the twin wires. The tension is not strong enough to pull the twin wires through the end sections. However, where the crimping is insufficient, the end sections will pull away, thus avoiding the inconvenience, later, of a faulty arch in the mouth. By turning the knob, the arms are forced apart, pulling the end sections with them until the desired opening is secured.

2021 Grand Concourse.

Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

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Where Does the Actual Abnormality in Distoclusion Lie? By Dr. Lucien de Coster Brüssels, *Deutsche Zahn-, Mund- und Kieferheilkunde* **8**: No. 2, 1941.

The main abnormalities in distoclusion Class II, Division 1 (Angle) are as follows:

1. Infantilism of the upper part of the face, primarily in a vertical direction.
2. A comparatively too high stage of development of the occlusion (dental age) in relation to bone development (bone age).

It is as if the teeth had developed at too fast a pace for the bone so that pronounced abnormality, especially in a forward direction, developed. This mesial shifting of the teeth produces the following consequences:

1. An unlocking of the mandible from the maxilla.
2. A change in the axial inclination of the teeth.
3. An insufficient widening of the maxillary apical base.
4. The tendency of the mandible to rest distally and to change its form.
5. An insufficient transverse growth of the mandible and later lack of development of the angle.
6. An unfavorable position of the upper dental arch in relation to the mid-point of the lines of the force of the muscles. Weakening of the muscles of mastication as a result of mechanical functional neglect.

The actual abnormalities, Class I, Division 1 (Angle), lie in the disharmonious development between the bone system and the teeth, that is, between the basal system and the supporting tissues. The mesial shifting of maxillary teeth is connected with a general infantilism of the maxilla.

Adiposogenital Dystrophy: By Ralph H. Kunstadter, M.D., *J. A. M. A.* **117**: 1947, 1941.

Many children with small genitalia are unjustly labeled "pituitary type," Fröhlich's syndrome or adiposogenital dystrophy. Pronounced obesity in itself may conceal the actual size of the genitalia so that a false impression may result unless careful examination is carried out.

Babinski and Fröhlich over forty years ago described cases of obesity with hypogenitalism secondary to expanding lesions in the region of the pituitary body. A few years later Bartel applied the term adiposogenital dystrophy.

In the past twenty years a great deal of experimental evidence has indicated that the pituitary and the region of the hypothalamus are concerned with growth, sexual development, certain phases of metabolism and obesity, although the exact relationship of these structures to obesity is not clearly understood. From a clinical point of view, children who show definite evidence of hypogenitalism associated with pronounced obesity which cannot be explained on the basis of overeating in a broad sense, may be considered as presenting adiposogenital dystrophy.

Adiposogenital dystrophy occurs more often in females than in males, but the latter are seen more frequently because genital infantilism is more conspicuous. The onset may occur at any age. Often there is a rather sudden and progressive increase in weight, beginning between the ages of 7 and 10 years, which is out of proportion to the food intake.

These patients are usually endowed with normal intelligence and may be indolent and good natured. Not infrequently they are introspective because of self-consciousness. Roentgenograms of the skull usually reveal no abnormal changes. Occasionally enlargement and erosion of the sella indicative of an expanding lesion, calcification within the sella, or a sella considerably smaller than normal may be present.

Dietary management and correction of faulty eating habits are essential in all obese patients regardless of the etiology. Unless there is definite evidence of hypothyroidism, thyroid is of little value and may even be harmful. Also it frequently stimulates the appetite.

Hypothyroidism in Childhood: By E. Kost Shelton, M.D., *J. A. M. A.* **117**: 1948, 1941.

There are three types of hypothyroidism during childhood, namely cretinism, juvenile myxedema and borderline hypothyroidism. As a matter of fact they are all one and the same disorder modified according to (a) the severity and (b) the length of time during which the patient has been subjected to the deficiency.

Until recently the more conservative observers were unwilling to concede any form of hypothyroidism which could not easily be classified under cretinism or myxedema. When analyzed closely, such a stand is not tenable. In common with most other secreting organs there is a margin of safety between the physiologic requirement of the thyroid and its functional capacity, but there is a threshold below which the gland may be said to be embarrassed rather than actually devoid of function. Such a mild disturbance encountered at any age, but more commonly in early adolescence, cannot be classified under cretinism and rarely develops myxedema.

The element of time is of equal importance. A mild degree of hypothyroidism for a short period, at any stage of development, will likely not be reflected objectively in the somatic or mental makeup. Over a period of years, however, even a mild degree of thyroid deficiency must leave its mark on both the soma and the psyche.

The classic hypothyroid child is still the dwarfed, lethargic, edematous, pot bellied, alabaster skinned, constipated imbecile it always has been.

Every child with severe untreated hypothyroidism will show retardation of osseous development when the disorder has existed for a period long enough to be reflected in the somatic makeup. The basal metabolic rate will be found to be low, between minus 20 and minus 40 per cent. Most, if not all, observers in recent years have demonstrated blood serum cholesterol values ranging from 50 to 200 per cent above the average normal. Children with severe hypothyroidism, untreated, excrete considerably less creatine in the urine than a similar group of normal children.

The basal metabolic rate is both mechanically and mathematically difficult to obtain in the average child, particularly the mentally inapt child. It is therefore not a practical diagnostic procedure in the young child. In older, more tractable, children and in adolescence it is a part of the diagnostic procedure. Even here, too much dogmatism is employed in an interpretation of the findings.

Bone age continues to be the most objective evidence of the developmental status of the child; but, while children with true hypothyroidism of long standing will have retarded osseous development, the reverse is not necessarily true. If the child is retarded two years or more according to some accepted standard (and all of the standards are within a few months of one another), try to prove or disprove hypothyroidism in the patient by every other means. Do not use the wrist or any other roentgenogram as the sole diagnostic criterion. On the other hand, even severely hypothyroid patients will have no reflection of their difficulty in the osseous development unless the condition has been present for a number of years. So it is even possible for a child with severe but recent hypothyroidism to have a normal bone age.

The blood serum cholesterol is not pathognomonic of mild or borderline hypothyroidism because values vary even in the classic case. Persistent high blood cholesterol values otherwise unaccounted for are very suggestive, however, particularly if corroborated by other physical or laboratory criteria. The bone age, the cholesterol, and the creatine excretion are informative but not diagnostic.

Variations from the classic clinical picture are important diagnostic criteria. There may be something in the history, the appearance of the skin, the temperature, the pulse, the hair, the stature, the posture, the teeth or the voice to initiate the investigation. Overweight is a very poor diagnostic sign.

Classic hypothyroid children, with few exceptions, respond promptly to ingested thyroid. The oxygen consumption increases, the basal metabolic rate rises, the bone age in relation to chronologic age increases, the blood serum cholesterol falls, the urinary excretion of creatine increases, the patient's height increment is enhanced, the infantile characteristics disappear, and cerebration improves. Too many children with developmental anomalies, birth injuries, mongolism and wholly unallied disorders, to say nothing of constitutionally inadequate children, are put carelessly on thyroid without an adequate investigation.

The 1941 Year Book of Dentistry: Edited by Charles G. Darlington, M.D.; George W. Wilson, D.D.S.; Howard C. Miller, D.D.S.; Walter H. Wright, D.D.S., Ph.D., and George R. Moore, D.D.S., M.S. Pp. 792, Price $3.00, Chicago, The Year Book Publishers, 1941.

The Year Book is today, as it has been in the past, a useful and practical investment for the dentist. The variety of topics covered and the manner in which they are presented, makes it possible for the dentist to use the Year Book both as a text and reference book.

A greater number of journals is represented in the current edition than in previous years. These journals include local bulletins, publications of special groups, state journals, and national publications. Articles of dental interest appearing in medical journals are well represented.

Now in its sixth edition, the Year Book of Dentistry is no longer in the experimental stage, but has become a fixture in dental literature. As in previous years, the Year Book includes articles published in the dental periodical press throughout the world. This is especially noteworthy in view of the present increasingly unsettled world conditions. It is to be regretted however, that the Latin-American journals are hardly represented. We in the United States have too long neglected our colleagues to the South. This was not the case with the dental profession in the Axis countries, as can be testified by the abundance of references to German, Italian and Japanese dental articles in the magazines of South American countries.

While the Year Book is profusely illustrated, the "cuts" used vary from excellent halftones to rather poor illustrations of questionable value. It would be much better to use fewer illustrations of definite value rather than to include copies of figures which are meaningless because they are blurred and of a size which makes it impossible for the reader to follow them.

Darlington, assisted by the staff of the Department of Pathology, New York University College of Dentistry, has maintained in the present volume, his usual high standard of selection and preparation of articles abstracted. Many articles are included in this section from journals which do not usually come within the purview of the general practitioner of dentistry, but which can, nevertheless, be of assistance to the dentist in his daily ministrations to his patients.

The section of Operative Dentistry covers a wide field as presented in the Year Book. The articles selected are, however, of unequal value and some of questionable practical assistance either to the public health dentist or to the private practitioner.

Oral Surgery, as edited by Howard C. Miller, contains many valuable abstracts on war surgery of the face and jaws which is of especial interest at this time. Prosthetic dentistry, under which is included crown and bridgework, carries descriptions of the use of acrylic resins for the construction of crowns, inlays, and bridges. A section is included also on research in dental materials, as it appeared in American and foreign dental journals during the past year.

Orthodontics is presented by Moore, assisted by the staff and graduate students in the Department of Orthodontics, School of Dentistry, University of Michigan. Growth theory and orthodontic practice are reviewed in terms of the contributions of Krogman, who views the general vertebrate plan of growth as

occurring along a primary longitudinal axis with cephalic and caudal ends, and two secondary axes—dorsoventral and lateral—at right angles to each other. The work of Brodie, Schour and Massler is discussed.

The present tendency in orthodontics toward extraction of teeth as a therapeutic measure is presented. One gathers from the papers discussed that early supervision by the dentist of the developing dentition of the child, and timely extraction of deciduous teeth retained past their physiologic and developmental period, may be of great assistance in treating forward drift of the lateral series of teeth which frequently necessitates extraction of permanent teeth in treating malocclusion later in the life of the child.

Moore objects to the statements made by Harriet Mitchell, a noted child psychologist, who sees in thumb-sucking a normal activity of the infant, which should never be directly interfered with. It is Moore's contention that "Thumb-sucking can be stopped in practically every instance without hazard to the child, but certainly with great saving of future worry and expense to the parent."

Shock: Blood Studies as a Guide to Therapy: By John Scudder, M.D., Med. Sc.D., F.A.C.S., from the Surgical Pathology Laboratory of the College of Physicians and Surgeons, Columbia University, and the Department of Surgery, the Presbyterian Hospital, New York City. 55 illustrations, 5 plates, Pp. 313, Price $5.50, Philadelphia, J. B. Lippincott Company, 1940.

Shock may arise as a result of burns, accidents, surgical operations, dehydration, trauma, and hemorrhage. In severely traumatized patients the correction of shock is the first therapeutic measure undertaken. This volume provides accurate, simple and efficacious methods for treating shock. Case histories are provided illustrating the various treatments available and the results are analyzed. A short laboratory manual is provided to enable the practitioner to employ tests for shock in his office and elsewhere.

There are various theories on the causation of shock, among which are the following: (a) Toxemia—toxins from damaged tissue produce cellular disintegration and altered chemical composition of the blood. (b) Hemorrhage—the theory is that the fluid loss itself is the cause of shock. (c) Neurogenic—nervous exhaustion and overactivity of the sympathetic nervous system affects the blood chemistry and other body fluids. (d) Adrenal exhaustion—the adrenals are indispensable to life.

Scudder analyzes the blood changes in shock in great detail. The action on the nervous and muscular systems is explained. It is now generally agreed that shock is caused by an alteration in the potassium metabolism, a derangement which is an indication of profound cell injury. The treatment of shock is discussed in its various aspects. Among the therapeutic measures used are heat; the administration of fluids, transfusions, control of pain, oxygen administration, emeties and lavage. The application of heat tends to restore deficient body heat and lessens vasoconstriction. Since hyperpotassemia is present in shock, the administration of sodium solutions intravenously tends to maintain a normal balance between intracellular potassium and extracellular sodium. Control of pain, mainly by immobilization, is advocated.

This is an authoritative book based on clinical experience, as well as experimental and laboratory investigations. An exhaustive bibliography is appended. This book will be found indispensable by the practitioner who is called upon to treat shock. During these war days one can never tell when he may be called upon for such treatment. The book has an excellent index.

J. A. S.

Active Immunization Against Tetanus: By H. Gold, *Ann. Surg.* **114:** 1061, 1941.

Ramon and others have proposed vaccination with tetanus toxoid as a routine public health measure to provide permanent immunity against tetanus and to overcome the limitations of passive immunization.

In the present communication, Gold reviews the recent publications of various research workers who have attempted to determine the optimum dosage and method of administration of tetanus toxoid which can be depended upon to obtain a permanent immunity against tetanus.

The author feels that active immunization, to be of value, must engender a titer at least equivalent to that produced by the subcutaneous injection of 1500 units of tetanus antitoxin. As the result of his own clinical research, Gold concludes that the subject should show at least 0.10 units of tetanus antitoxin per c.c. of serum following the injection of a primary course or "repeat" dose of tetanus toxoid.

The author further concludes that active immunization against tetanus is both practical and safe. Two doses (0.5-1.0 c.c.) of alum-precipitated or plain toxoid are given about three months apart in order to establish a basic (primary) immunity. A repeat injection of toxoid (1.0 c.c.) should be given whenever an injury occurs. Topagen toxoid (0.1 c.c. in each nostril, on three successive days) may be used in lieu of the "repeat" injections. It also seems that immunization against tetanus, diphtheria, and typhoid fever may be accomplished simultaneously by the use of a mixed antigen.

Harry A. Salzmann, M.D.

El Paradencio: Su Patología y Tratamiento (The Paradentium: Its Pathology and Treatment): By Francisco M. Pucci, D.D.S., of Montevideo, Uruguay. Second edition, thoroughly revised, 698 pages, 764 text illustrations, 46 plates, 8 color plates, Price $14.00. Casa a Barreiro y Ramos, S. A., publishers. Montevideo, Uruguay, 1941.

The second edition of Pucci's work should be considered as one of the major contributions to dental literature. Dentistry, not only in South America, but throughout the world, may well feel proud of this publication. The wealth of illustrations makes this book valuable not only to those who have a reading knowledge of the Spanish language, but also to those whose knowledge of this language is limited. The author deserves the highest tribute; he has completed a Herculean task in an excellent manner. Nowhere has this reviewer seen finer photomicrographs nor more complete bibliographic references than in this volume.

The book is divided into two parts. Part One deals with the biology and pathology of the paradontium and Part Two is devoted to clinical periodontia. The chapter on the fundamentals of periodontology is excellently illustrated and shows the comparative anatomy, normal and pathologic anatomy, and physiology of the periodontal tissues. Pucci displays unusual erudition in his knowledge of the subject with which he deals. The physiology of occlusion is explained in great detail from the standpoint of the ideal occlusion, as well as its deviations, and the etiology of periodontal disease is presented in its various aspects.

The magnitude of this book is such that it may be considered an encyclopedia on periodontology and dental and oral diseases. A summary is provided on each of the subjects treated in the book. Part Two, which deals with the clinical aspect of periodontia, is profusely illustrated. Techniques are explained in detail and will be found easy to follow. No phase is neglected, even to the sharpening of instruments. Various methods of tooth-brushing are explained and illustrated and many dentifrice formulas are included.

Pucci closes his monumental work with a chapter on the social importance of the periodontist and the general practitioner of dentistry. It is his belief that it is the duty of the afore-mentioned practitioners to lead in the education of the public as well as in clinical practice to the end that the dental organs may be conserved and diseases of the mouth eliminated. From an educational standpoint, it is the author's belief that patients should be instructed in what to do, as well as how to avoid the worthless and frequently harmful nostrums.

A detailed index is provided. The publishers of this book are to be congratulated on the splendid job of bookmaking which they have accomplished in making a fitting dress for an extremely worth-while publication.

J. A. S.

Prevention of Malocclusion: By Paul Guy Spencer, D.D.S., Certified by the American Board of Orthodontics; Past President of the American Society of Orthodontists. First edition 254 pages, 217 illustrations. Cloth, $5.00, St. Louis, 1941, The C. V. Mosby Co.

The general theme running through this book from beginning to end is—"It is more noble to prevent than to cure." Any book written with such an objective is deserving of consideration. But when it deals with the problems relating to the "Prevention of Malocclusion," it is of vital concern to every dentist. To do justice to such a broad subject necessarily requires the exploration of a wide field. Dr. Spencer does this very thing with twenty-eight chapters and two hundred seventeen illustrations. To read and study this book gives one a greater awareness of his responsibilities and the tremendously important part he can play in directing growth and development along the right channels. Although the dentist can do little about true hereditary influence, it is pointed out that it only too frequently gets the blame, when, as a matter of fact, the exciting causes are usually of local or constitutional origin, or frequently both. Rightly, great emphasis is placed on the proper utilization of knowledge for control of the local and the constitutional disturbances.

The author apparently well remembers the general disregard given to impending dental anomalies during his early days of general practice. This coupled with his greater enlightenment as a specialist and having to bear witness and testimony on cases seeking relief over a period of many years has undoubtedly prompted him to prepare this volume for the purpose of inspiring and directing the profession on how best to cope with these commonplace problems.

The subject matter and numerous illustrations indicate that it is the fruition of many years' study and observation. When one analyzes the chapters on Possibilities and Limitations, Examinations, Classification, Growth and Development, Armamentarium, Methods of Treatment, Child Psychology, Business Methods and the other correlated subjects, he gets the feeling of having read a digest of current literature on juvenile dentistry. The commonplace and more perplexing problems are graphically portrayed with concise explanations and numerous pictures so that any alert dentist can quickly grasp their meaning and application. Dr. Spencer is right in believing that the dentist's greatest sphere of orthodontic usefulness lies not in vain and impractical attempts at treating confirmed types of malocclusion, but rather in the great field of rational care and treatment for prevention. Herein, as he so ably points out, is the fertile field for cultivation with profit unto his patients and himself. The author has done an excellent job of streamlining, in a logical manner, the theories relating to dental growth and development. The determining factors are vividly introduced, and practical methods for control are presented with a justified hope that many more children may be brought up with a satisfactory functional and anatomic relationship of their dental structures. Special emphasis is placed on the basic working principles of regular periodical examinations, proper home care (parental cooperation), and early and timely treatment. Thus a really sound basis is outlined for the prevention of dentofacial anomalies, the vast majority of which are the sequelae of local disturbances. By removing and controlling these predisposing and exciting causes by clinically approved methods, it is safe to assume that many objectionable and otherwise severe and complicated cases may be appreciably reduced. It becomes evident to the reader that Dr. Spencer considers the etiology of malocclusion almost synonymous with prevention for "principal causes" and "combative methods" are the salient features in every chapter. The control age is visualized as being from genesis to adolescence with the greatest opportune time for the dentist being between four and twelve years of age.

It is packed full of vital information in a realistic way. All practitioners have long felt the need of specialized consultation service to help solve the many unexpected and complicated problems which they run into from day to day. They require sound advice and reliable treatment if the practitioner is to protect the dental welfare of his clientele properly and improve his public prestige and income. To have this book for reference would be the next best thing to having the personal consultation services of a specialist possessing the broad knowledge and experience needed for solution of these problems.

This condensed treatise should be of special interest to teachers and junior and senior dental students, as it contains most of the elementary and funda-

mental requisites for the prevention of malocclusion. When one sees such informative and practical textbooks offered to the profession by reliable authors on subjects of great importance, it makes you wonder why textbooks are not used more by teachers, students, and practitioners.

This book deserves a place in the "handy library" of every dental practitioner.

T. W. Sorrels, D.D.S.

Editorials

The Inter-American Meeting

The forty-first annual meeting of the American Association of Orthodontists and Inter-American Orthodontic Congress, held at the Roosevelt Hotel in New Orleans, March 16, 17, 18, and 19, 1942, has just closed, and no doubt much will be heard of this meeting for a long time to come.

The annual affair was unique in several ways, but more particularly because it carried a Latin American atmosphere that was both interesting and constructive.

The registration desk revealed an attendance of 223 members, 112 guests, about 25 Latin American dentists, and 129 ladies, making a total of 464 persons attending the meeting. The guests of honor, our neighbors to the south, were as follows:

Argentina	Dr. David Cohen
Bolivia	Dr. Jaime Zamorano
Brazil	Dr. Virgilio Moojen de Oliveira
Chile	Dr. Luis de la Carrera
Colombia	Dr. Alberto C. Botero
Costa Rica	Dr. Roberto Chartier
Cuba	Dr. Sergio Giquel
Dominican Republic	Dr. Horacio Read
Ecuador	Dr. Enrique Ripalda
El Salvador	Dr. Benjamin Zavaleta
Guatemala	Dr. Alfredo A. Morales
Haiti	Dr. Jules Thebaud
Honduras	Dr. Alberto F. Smith
Mexico	Dr. Samuel Fastlicht
Mexico	Dr. Matias Muraira
Mexico	Dr. Rutillo Blanco
Nicaragua	Dr. Fernando Fuentes
Panama	Dr. Manuel M. Diaz
Paraguay	Dr. Rodolfo Pagano
Peru	Dr. Ricardo Salazar
Uruguay	Dr. Oscar Aldecoa
Venezuela	Dr. Jose Araujo Carrillo

Subsequent to the meeting a two-day clinic was held, particularly for the benefit of the Latin American guests. Contributing their services to the two-day clinic were several of the outstanding teachers of orthodontics in the United States: Drs. Hermann Becks, Frederick B. Noyes, Holly Broadbent, John Mershon, and Milo Hellman. These clinics were under the direction of Drs. Jas. D. McCoy, Oren A. Oliver, Spencer R. Atkinson, Samuel J. Lewis, Lowrie J. Porter, and Geo. H. Herbert.

Following these sessions the Latin American guests went to Washington, D. C., where they were given a five-day postgraduate course in general dentistry at the Army Medical Center, under the direction of Brigadier General Leigh C. Fairbank and Colonel Lowell B. Wright, Director of the Army Dental School.

On the entertainment side the state stag dinner given Monday night in honor of the Latin American men and the banquet Wednesday evening, at which time the Latin American men were introduced one by one, were both high lights of the occasion. These affairs, as well as the day at golf, were beautifully handled and reflected fine cooperation on the part of the committees in charge.

On Wednesday evening of the meeting the formation of a permanent organization was completed by the Latin American delegates. The following were named as the officers and governing committee of the Congress:

Dr. Claude R. Wood, President, Knoxville, Tenn.	Representing U. S. A.
Dr. John Ross, Sec. & Treas., Philadelphia, Pa.	Representing U. S. A.
Brig. Gen. L. C. Fairbank, Washington, D. C.	Representing U. S. A.
Dr. Vernon Fisk, Toronto, Canada	Representing Canada
Dr. Sergio Giquel, Havana, Cuba	Representing W. Indies
Dr. Samuel Fastlicht, Mexico City	Representing Mexico
Dr. Alfredo Morales, Guatemala, Guatemala	Representing Central A.
Dr. Armando Monti, Buenos Aires, Argentina	Representing South A.
Dr. Ricardo Salazar, Lima, Peru	Representing South A.
Dr. Oscar Aldecoa, Montevideo, Uruguay	Representing South A.

The entire Congress under the direction of Dr. Wood and his highly cooperative committees was an outstanding success, and it is to be hoped, as a result thereof, that there will be even closer cooperation between all of the orthodontists in the Western Hemisphere in the future.

Adios amigos y esperemos, vernos, pronto en el futuro.

H. C. P.

Brigadier General Leigh C. Fairbank, United States Army

It is thought by many members of the American Dental Association that the superlative dental program created by the Surgeon General's office, under the leadership of Brigadier General Leigh C. Fairbank, is one of the most important single accomplishments in the entire history of the dental profession. This program emphasizes the importance of normal oral health to the general health of the United States troops.

Although precedent decrees that the ranking officer of the Dental Corps of the Army be replaced after a term of four years, it was a surprise to learn that on March 9, 1942, the War Department decided not to reappoint Brigadier General Fairbank to the important post which he has held with such great credit to the Army, to the profession, and to himself.

General Fairbank is a personable and a highly efficient officer, and his wide acquaintance among the dentists of North and South America has made him a particularly valuable man in the position from which he has been retired. It is understood that he will now enter private practice in Washington, D. C. He will return to the practice of orthodontics inasmuch as he has enjoyed wide

experience and training in that particular specialty of dentistry. In his retirement General Fairbank will, no doubt, carry with him the handclasp of a host of friends and admirers in the dental profession—they will figuratively "doff their hats" and say to the General, "A big job and well done indeed."

Brigadier General Robert H. Mills, United States Army, who succeeds General Fairbank and who is a highly capable officer, will undoubtedly receive the full coopèration of General Fairbank, as well as the entire dental profession, in taking command of the Dental Corps of the United States Army. The AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY joins in wishing him continued advance and great success of the Dental Corps of our Army.

H. C. P.

Special Article

A Message to the Dental Profession

By Oren A. Oliver

The tragic consequences of war seem now to be engulfing all the earth. The present world war seems destined to make the conflict of a quarter of a century ago look like a local skirmish.

In the program of American defense preparedness, dentistry must take its proper place. One of the important requisites is the classification of all dentists, including information which is pertinent in a time of national emergency, as to how many dentists will be in direct military service and how they will be distributed.

Classification is never easy. The listing and classifying of all the members of a nationwide profession are difficult, indeed. Perhaps before there is real accuracy possible, there must be not only the original replies to questionnaires, but also checking and double-checking. There is information pertaining to people which must be secured in any accurate investigation, that they are unable to state accurately themselves.

An effort will be made to learn the names of dentists who will volunteer for active professional service to meet the Government's needs. At the present time this is on a voluntary basis; however, the needs of the Government must be met even if ultimately it becomes necessary to put this on an involuntary basis.

The new Procurement and Assignment Service of the Office of Defense Health and Welfare Services, recently organized in Washington, D. C., should prove to be a valuable agency in coordinating an equitable distribution of dentists, physicians, and veterinarians to meet the needs of both the civilian population and the armed forces. Through the American Dental Association questionnaires previously sent out, the necessary groundwork has now been outlined for this survey.

Army dental service, in time of war, necessarily will function under severe handicaps that are not encountered in civilian practice; nevertheless, a high standard of service must be maintained. It is to be expected that proportionately greater numbers of trained dental personnel will be needed for the armed services than would ordinarily be required by a numerically equivalent civilian population.

The American people are imbued with the determination to achieve a decisive victory in this war; consequently they will insist on adequate care for the health of their soldiers. This can be accomplished only by providing trained personnel in sufficient numbers to meet the heavy demands of our armed forces.

The final steps in the printing and mailing of the enrollment form and questionnaire for dentists, physicians, and veterinarians, described in the special article on the Procurement and Assignment Service which was published in the March issue of the *Journal of the American Dental Association,* are now being

completed. Every dentist who receives the enrollment form and questionnaire should return it immediately in the franked envelope which will be enclosed. He will have an opportunity to indicate a preference for various types of service, provided he can justify his choice. Once he has enrolled, he will receive a certificate indicating his enrollment for war service, and he will be privileged to wear the official button of the Procurement and Assignment Service. This does not mean that he is enlisted in the armed forces, but simply signifies that, as a result of his having expressed his willingness to be of service, he has been given an opportunity to select the type of service he prefers. Let each dentist show his eagerness to help, and let each one be prompt about it. It must never be said of the dental profession that it gave too little, and too late.

News and Notes

Survey of the Income of the Dental Profession by the American Dental Association and the Department of Commerce

In a previous news release the Committee on Economics of the American Dental Association announced to the members of the dental profession that a survey was to be made of the economic status of the dental profession. The survey was planned as a joint endeavor of the American Dental Association and the Department of Commerce.

The mailing of the questionnaire from which the information is to be obtained for the study was begun about two weeks ago, and is now almost completed. The questionnaire is being sent to all practicing dentists, both members and nonmembers of the American Dental Association. A large number of returns have already been received, and there is every indication that the members of the profession are going to cooperate wholeheartedly with the survey.

The question has been raised by some as to whether the questionnaire might be utilized for any purpose other than that of computing the "average income" for large groups in the dental profession. The Committee on Economics wants to assure you that this is the sole purpose of the survey and that no governmental agency other than the Department of Commerce will have access to the individual returns.

You are not asked to sign the questionnaire and we assure you that your return will remain completely anonymous. A few have questioned the significance of the number appearing on the lower margin of the questionnaire. This number (2.11281) is merely a form number and is identical on all of the questionnaires.

If the American Dental Association is to represent and serve organized dentistry intelligently, it is essential that the Association have at its disposal exact information on a variety of subjects relating to the practice of dentistry. Information regarding the economic status of various sections of the dental population is of vital importance in this respect; consequently, the Committee on Economics urges your cooperation.

If you have any questions regarding the questionnaire the Secretary of the Committee will be glad to hear from you.

R. M. Walls, D.D.S., Chairman
M. L. Dollar, Secretary.

Procurement and Assignment Service Announcement

The Dental Preparedness Committee of the American Dental Association has received the following announcement from Major Sam F. Seeley, Executive Officer of the Procurement and Assignment Service:

From now on, until the order may be changed, any dentist who may be classified in Class 1A may make application for a commission, and if found capable of meeting the physical and professional requirements, will be granted a commission regardless of quota.

To make application a letter should be directed to the Procurement and Assignment Service, 601 Pennsylvania Avenue, N. W., Washington, D. C., requesting application blanks. These blanks will be forwarded and from that point on the routine for clearance which has been established will be followed. To learn this routine one can refer to the article on Procurement and Assignment Service which begins on page 466 of the March issue of the *Journal of the American Dental Association.*

Cleveland Dental Society

The annual spring Clinic Meeting of the Cleveland Dental Society will be held May 4 to 6, 1942, at the Statler Hotel, Cleveland, Ohio.

Ontario Dental Association

The Seventy-Fifth Annual Convention of the Ontario Dental Association will be held at the Royal York Hotel, Toronto, Ont., May 18 to 21, 1942. Dentists from the United States and all parts of Canada are welcome.

Western Reserve Dental Alumni Association

The Western Reserve Dental Alumni Association announces the Fiftieth Anniversary celebration Monday, June 8, 1942, including an alumni clinic, class reunions, and dinner at the Mid-Day Club.

Joseph R. Gould, Secretary-Treasurer
630 Rose Bldg., Cleveland, Ohio

New York Society of Orthodontists

The meeting convened on Feb. 23 and 24, 1942, at the Hotel Waldorf-Astoria, New York, N. Y., with Dr. Sidney Riesner presiding. Orthodontists from the New England and Middle Atlantic states, several from Canada and other district societies, as well as many guests were in attendance. The announced program was made the order of procedure. It was voted by the Society to purchase defense bonds in the amount of $1,000.

President Riesner reported on communications received from various orthodontic supply houses asking that orthodontists should not purchase materials and supplies beyond their immediate needs less they create a shortage of materials necessitating rationing of the same.

It was unanimously voted to place the name of Dr. David T. B. Houston on the retired list of the Society's membership. The committee appointed to report on the President's address made the following recommendations:

1. "That our delegate to the American Association of Orthodontists be instructed to have that Association take the necessary steps to obtain priority ratings for orthodontic supplies.

2. "It is further recommended that our members refrain from accumulating more material than is necessary for the conduct of their practice.

3. "Inasmuch as the problem of borderline membership is to be presented to the American Association of Orthodontists by our Delegate, the Committee has no other recommendation to make."

The following officers were elected for the coming year: President, E. Santley Butler; President-Elect, William C. Keller; Vice-President, Alfred M. Desnoes; Secretary-Treasurer, Norman L. Hillyer; Editor, J. A. Salzmann; Sidney E. Riesner, member of the Board of Censors (3 years); Director, Fred R. Blumenthal; Alternate, Raymond L. Webster.

The following members were elected: Henry C. Beebe, Matthew M. Kaufman, Joseph L. McDowell, Emil O. Rosenast, Brainerd F. Swain, William Wedeen, Active Membership; Solomon L. Katz, Associate Membership; Augustus L. Wright, Reinstatement.

J. A. S.

Notes of Interest

Dr. Norris C. Leonard announces the removal of his office from Baltimore to 1102 Bennie-Dillon Building, Nashville, Tenn. Practice limited to orthodontics.

Dr. Floyd E. Gibbin and his associate Dr. Effie M. Milner announce the removal of their offices from 333 Linwood Avenue to 405 Linwood Avenue, Buffalo, N. Y. Practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES*

American Association of Orthodontists

President, J. A. Burrill - - - - - - - - - - - 25 East Washington St., Chicago, Ill.
Secretary-Treasurer, Max E. Ernst - - - 1250 Lowry Medical Arts Bldg., St. Paul, Minn.
Public Relations Bureau Director, Dwight Anderson
- - - - - - - - - - - - - - - - - - 292 Madison Ave., New York, N. Y.

Central Association of Orthodontists

President, Harold J. Noyes - - - - - - - - - 55 E. Washington St., Chicago, Ill.
Secretary-Treasurer, L. B. Higley - - - - - - - - 705 Summit Ave., Iowa City, Iowa

Great Lakes Society of Orthodontists

President, Henry D. Cossitt - - - - - - - - - - 942 Nicholas Bldg., Toledo, Ohio
Secretary-Treasurer, C. Edward Martinek - - - - - - 661 Fisher Bldg., Detroit, Mich.

New York Society of Orthodontists

President, E. Santley Butler - - - - - - - - 55 Locust Ave., New Rochelle, N. Y.
Secretary-Treasurer, Norman L. Hillyer - - - - Professional Bldg., Hempstead, N. Y.

Pacific Coast Society of Orthodontists

President, Ben L. Reese - - - - - - - - - - - Roosevelt Bldg., Los Angeles, Calif.
Secretary-Treasurer, Earl F. Lussier - - - - - 450 Sutter St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, George H. Siersma - - - - - - - - - 1232 Republic Bldg., Denver, Colo.
Secretary-Treasurer, Curtis L. Benight - - - - - - 1001 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, W. P. Wood, Jr. - - - - - - - - - - 442 W. Lafayette St., Tampa, Fla.
Secretary-Treasurer, E. C. Lunsford - - - - - - 2742 Biscayne Blvd., Miami, Fla.

Southwestern Society of Orthodontists

President, E. Forris Woodring - - - - - - - - - Medical Arts Bldg., Tulsa, Okla.
Secretary-Treasurer, R. E. Olson - - - - - - - Union Nat'l Bank Bldg., Wichita, Kan.

American Board of Orthodontics

President, Charles R. Baker - - - - - - - - - - - 636 Church St., Evanston, Ill.
Vice-President, Frederic T. Murlless, Jr. - - - - - 43 Farmington Ave., Hartford, Conn.
Secretary, Bernard G. DeVries - - - - - - - - Medical Arts Bldg., Minneapolis, Minn.
Treasurer, Oliver W. White - - - - - - - - 213 David Whitney Bldg., Detroit, Mich.
William E. Flesher - - - - 806 Medical Arts Bldg., Oklahoma City, Okla.
James D. McCoy - - - - - - - 3839 Wilshire Blvd., Los Angeles, Calif.
Joseph D. Eby - - - - - - - - - - 121 E. 60th St., New York, N. Y.

Harvard Society of Orthodontists

President, Harold J. Nice - - - - - - - - - 475 Commonwealth Ave., Boston, Mass.
Secretary-Treasurer, Edward I. Silver - - - - - - - 80 Boylston St., Boston, Mass.

Washington-Baltimore Society of Orthodontists

President, Paul W. Hoffman - - - - - - - - 1835 Eye St., N. W., Washington, D. C.
Secretary-Treasurer, Stephen C. Hopkins - - - - - 1726 Eye St., Washington, D. C.

Foreign Societies†

British Society for the Study of Orthodontics

President, S. A. Riddett
Secretary, R. Cutler
Treasurer, Harold Chapman

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*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

†The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis, Mo., U. S. A.

Delegates to the First Inter-American Orthodontic Congress

(Back Row, left to right) Dr. Manuel Moreno, Philadelphia, Pa., Chilean Consul. Delegates: Drs. Ricardo Salazar, Lima, Peru; Rutilio Blanco, Mexico City, Mexico; Samuel Fastlicht, Mexico City, Mexico; Rodolfo Pagano, Asunción, Paraguay; Luis dela Carrera, Santiago, Chile; Oscar Aldecoa, Montevideo, Uruguay; Claude R. Wood, President, U. S. A.; John W. Ross, Secretary-Treasurer, U. S. A.; Andrew F. Jackson, Chairman, Reception, U. S. A.; Enrique Ripalda, Quito, Ecuador; Jaime Zamorano, La Paz, Bolivia; Alberto F. Smith, Tegucigalpa, Honduras.

(Bottom Row, left to right) J. Benjamin Zavaleta, San Salvador, Salvador; Sergio Giquel, Havana, Cuba; V. Moojen de Oliveira, Rio de Janeiro, Brazil; Jose Araujo Carillo, Caracas, Venezuela, Fernando J. Fuentes, Managua, Nicaragua; Jules Thébaud, Port au Prince, Haiti; Horacio Read, Cuidad Trujillo, Dominican Republic; Roberto Chartier, San José, Costa Rica; Manuel M. Diaz, Panama City, Panama; Alfredo A. Morales, Guatemala, Guatemala; David M. Cohen, Buenos Aires, Argentina.